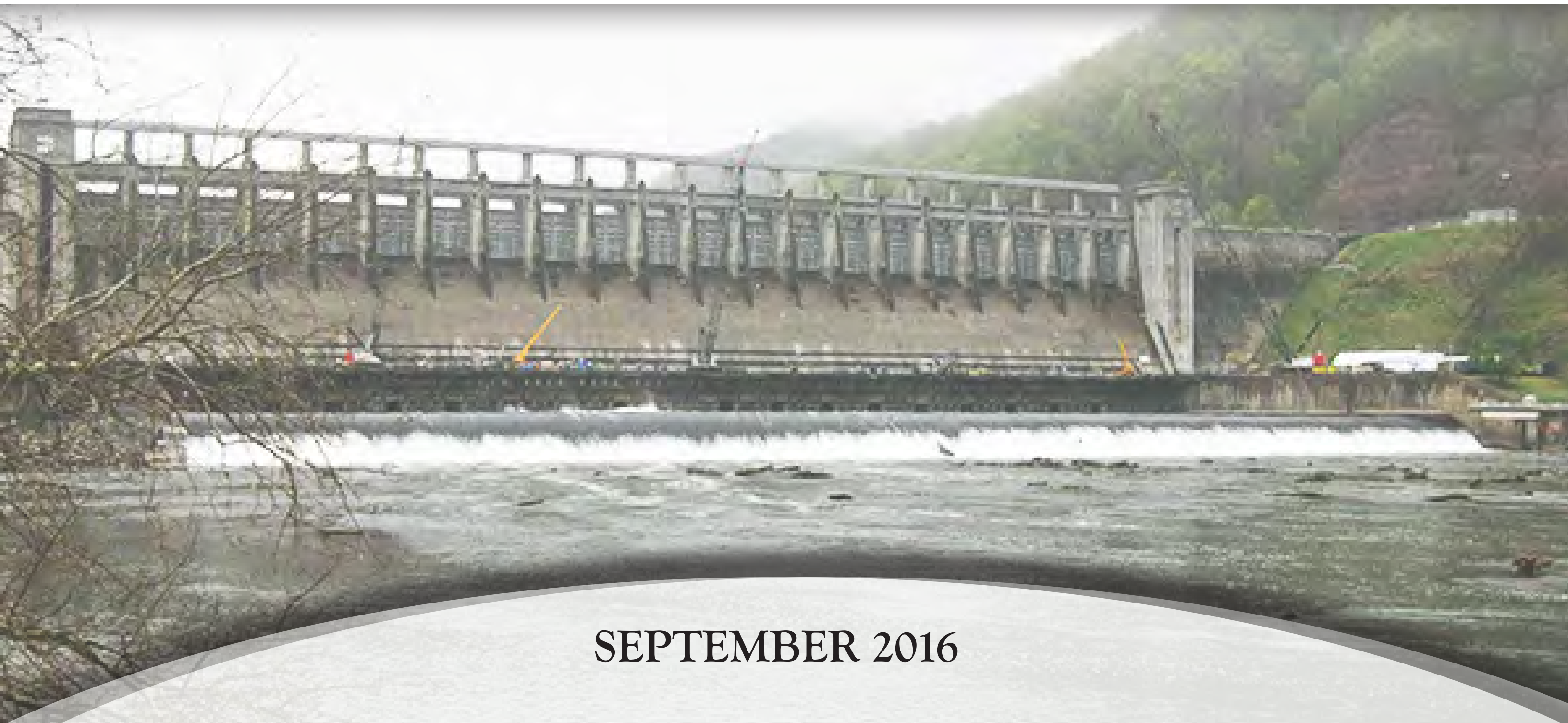
SUPPLEMENTAL DRAFT ENVIRONMENTAL IMPACT STATEMENT

BLUESTONE DAM SAFETY MODIFICATION

HINTON, WEST VIRGINIA

VOLUME I



SEPTEMBER 2016

U.S. Army Corps
of Engineers
Huntington District

Volume I

Supplemental Draft Environmental Impact Statement, Bluestone Dam Safety Modification, Hinton, West Virginia

U.S. Army Corps of Engineers
Huntington District
Huntington, West Virginia

September 2016

ORGANIZATION OF REPORT

This *Supplemental Draft Environmental Impact Statement, Bluestone Dam Safety Modification, Hinton, West Virginia* contains the following sections and is published in three volumes:

Volume I

Volume II

Volume III

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The objective of this Supplemental Draft Environmental Impact Statement (SDEIS) is to identify and analyze the potential environmental impacts that could result from proposed modifications to the Bluestone Dam. The SDEIS will supplement the 1998 Final Environmental Impact Statement (FEIS) and Record of Decision (ROD), which was prepared to address hydrologic deficiencies of the dam and modifications needed to safely pass flows of the updated probable maximum flood (PMF). A risk assessment of the Bluestone Dam identified additional safety concerns not originally assessed in the 1998 FEIS. This SDEIS is being prepared in accordance with the National Environmental Policy Act of 1969 (NEPA) and the Council on Environmental Quality's (CEQ) Regulations (40 Code of Federal Regulations [CFR] 1500-1508), as reflected in the U.S. Army Corps of Engineers (USACE) Engineering Regulation (ER) 200-2-2, *Procedures for Implementing NEPA*.

The USACE proposes additional modifications to Bluestone Dam to reduce the risk of catastrophic dam failure. The Proposed Action is to implement modifications to the existing stilling basin to prevent scour that could result in spillway monolith instability, and thus dam failure, during extreme flood events. The purpose and need of the Proposed Action is to reduce incremental risk associated with dam failure to below the USACE tolerable risk guidelines in order to provide public safety to communities downstream of the dam and allow the dam to function as originally intended and authorized. A Dam Safety Modification Study (DSMS) developed an array of alternatives to reduce additional risks and to meet tolerable risk guidelines. As a result of the screening process during the DSMS, two alternatives were carried forward. The environmental impacts of the following alternatives were considered in this SEIS.

<u>Alternative 1</u>: Hydraulic Jump Basin with Supercavitating Baffles – This alternative includes the modification of the existing stilling basin system with a protective concrete apron and larger baffles, among other features described in the SDEIS. Alternative 1 would also include a remotely controlled crest gate operating system, as well as non-structural risk management measures. Modification to the dam would occur over an eight to ten-year period. This alternative is the tentatively selected plan (TSP).

<u>Alternative 2</u>: No Action Alternative – This alternative includes the completion of Phases 3 and 4 of the 1998 FEIS project features and installation of an additional 66 monolith multi-strand anchors. The No Action Alternative would also include the installation of a remotely controlled crest gate operation system and non-structural risk management measures proposed in Alternative 1. No modifications to address the risk assessment-identified safety concerns would be implemented.

The SDEIS also discloses the impacts associated with the prolonged construction duration of modification features described in the 1998 FEIS.

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1.0 INTRODUCTION

1.0 INTRODUCTION

The U.S. Army Corps of Engineers (USACE) proposes to modify the Bluestone Dam near Hinton, WV such that risks associated with dam failure would be reduced to a “tolerable” level, as defined by USACE and described in Section 2.0. These modifications would not change the normal operating procedures for the dam following completion of necessary modifications, nor would the modifications enhance the present flood control capabilities of the dam. The modifications would, however, reduce the risk of catastrophic dam failure during extreme flooding.

The primary objective of this Supplemental Draft Environmental Impact Statement (SDEIS) is to evaluate the potential impacts resulting from the proposed dam modifications. The SDEIS also discloses the impacts associated with the prolonged construction duration of modification features described in the 1998 Dam Safety Assurance Study (DSAS) Final Environmental Impact Statement (FEIS), which this SDEIS supplements.

1.1 Project Purpose and Description

During construction of the 1998 DSAS features, a risk assessment of the Bluestone Dam identified additional safety concerns not addressed in the 1998 Dam Safety Assurance Report and FEIS. A subsequent Dam Safety Modification Study (DSMS) is being developed and includes a suite of alternative plans to address the potential failure mode of concern. These plans were then screened, resulting in the following two alternatives which are evaluated in this SDEIS:

<u>Alternative 1</u>: Hydraulic Jump Basin with Supercavitating Baffles – This alternative includes the modification of the existing stilling basin system with a protective concrete apron overlay, larger baffles and anchoring of numerous existing features, among other features described in Section 1.2. Alternative 1 would also include a remotely controlled crest gate operating system, as well as non-structural risk management measures. This alternative is the tentatively selected plan (TSP).

<u>Alternative 2</u>: No Action Alternative – This alternative includes the completion of Phases 3 and 4 of the 1998 DSAS project features and installation of an additional 66 monolith multi-strand anchors. The No Action Alternative would also include the installation of a remotely controlled crest gate operation system and non-structural risk management measures proposed in Alternative 1. No modifications to address the risk assessment-identified safety concerns would be implemented.

1.1.1 Preferred Alternative

Under the TSP, the modified stilling basin would remain a two stage system within the existing footprint with the following modifications and features:

- A protective concrete apron overlay for the approximately 180+ feet of natural riverbed in the first stage between the dam and the existing stilling weir
- Demolition of the existing first stage baffle blocks, endsill, and a portion of the existing apron slab and construction of new, larger, anchored blocks and resurfacing of the existing apron.
- Anchors in both the existing and new concrete slabs to stabilize against uplift pressures in the foundation created by underseepage from the reservoir
- Construction of new drainage features within the dam or first stage basin to relieve some of the uplift pressures
- Installation of stabilization anchors in the stilling weir and stilling basin training walls
- Installation of 10-foot high extensions of the existing spillway right and left training walls
- Addition of scour protection behind both stilling basin training walls
- Demolition/reconstruction and anchoring of the second stage concrete endsill and baffle blocks within their existing footprint to ensure stability and satisfactory performance
- Installation of means to remotely operate crest gates in order to reduce the life safety risk of dam operators during a flood event.
- Construction of a permanent divider wall to bisect stilling basin

Construction activities for the proposed action are estimated to last between eight and ten years, and would likely commence after, but not immediately after, the completion of Phase 3 and 4 of the 1998 Dam Safety Assurance (DSA) Project.

In order to allow for continued flow of water through the dam during construction, a permanent divider wall and temporary cofferdam would be constructed to allow dewatering in half of the stilling basin at a time. This staged construction would allow for continued use of eight of the sixteen sluice gates to maintain flow during construction.

In order to dewater the first and second stage stilling basin, a temporary cofferdam would be built across the downstream end of the second stage stilling basin. Several possible configurations for this cofferdam are under consideration. Regardless of the type of cofferdam used, this work would be accomplished in two stages, with half of the cofferdam being built and utilized for dewatering at one time. The right side (facing downstream) of the cofferdam would be built first, tying into the right penstock training wall, cross the channel downstream of the second stage baffle blocks, and tie into the cofferdam wall running perpendicular to the dam face. Once construction of the TSP is complete on the right side of the stilling basin, the right half of the cofferdam would be removed and the left side cofferdam would be built and utilized to dewater the left side of the stilling basin for construction of the TSP, tying into the left descending bank and the new divider wall.

A new drainage gallery would be mined through the concrete of the existing dam and tied to the existing drainage gallery. New foundation drains would be drilled from this gallery into the foundation under the dam. All of this work is confined to the interior of the existing dam.

Existing rock within the stilling basin would be removed using line drilling and an excavator and/or hoe-ramming. Any existing concrete to be demolished or removed from the existing structure would be removed using diamond saw cutting and/or hoe ramming. Excavated material would be stockpiled on site prior to disposal which meet all Federal and state laws and regulations including NEPA analysis. No blasting would be utilized for demolition of any features of the existing dam or foundation. It is estimated that approximately 150,000 - 250,000 cubic yards of material would be removed from the site during and after construction, which includes materials demolished from the existing structure as well as temporary material used during construction, such as the cofferdam.

USACE does not anticipate permanently acquiring any additional property or flowage easements under the TSP; however offsite property acquisition may be required for mitigation. Temporary easements may be required for access and staging area development. If during detailed engineering and design of the TSP additional off-site disposal or off-site mitigation sites are required, temporary or permanent easements may be required once any required supplemental NEPA documentation and permitting is completed.

1.1.2 Adverse Impacts of Selected Alternative and Mitigation Action

The construction of a temporary cofferdam for stilling basin dewatering would have direct and indirect adverse impacts on downstream botanical, wildlife, water, and aquatic resources through clearing of riparian vegetation, disturbance of aquatic habitat, downstream flow alteration and increased suspended solids. The use of only eight of the sixteen sluice gates to pass water through the dam would result in upstream adverse impacts to these same resources, as well as recreation resources, by causing an increase in the frequency, duration, and elevation of out of pool conditions within Bluestone Lake. This change in lake inundation would result in insignificant increased sedimentation and resulting vegetation stress, and would cause more frequent closure of recreational sites such as campgrounds and trails. All of these impacts would be long-term given the eight to ten-year construction duration of the TSP; however, most would be non-permanent. With the exception of the significant direct and indirect impacts to aquatic resources downstream of the dam due to construction and dewatering of the cofferdam, removal of the public fishing pier downstream, and moderate disruption of upstream recreation due to inundation, the other upstream and downstream impacts range from negligible to moderate.

Mitigation for these impacts to botanical, wildlife, water, and aquatic resources include: revegetation of riparian areas, seasonal restrictions on tree cutting, best management practices (BMPs) to control sediment and water pollution, and restoration of aquatic habitat both within the disturbed footprint and at an off-site location.

Mitigation for impacts to downstream recreation resources consist of replacement of the downstream fishing pier as well as other features further discussed in Chapter 7.

Construction of the TSP features would cause moderate adverse impacts on the ambient noise environment and local air quality, causing long-term but non-permanent adverse impacts to quality of life for nearby residents and recreational facilities. Long-term but non-permanent impacts are defined as those that would last more than one year but cease within one year of construction completion (estimated between eight to ten years). Construction noise would also continue to impact the use of the area's terrestrial habitat by some terrestrial wildlife species. Visual impacts to the dam and tailwater area would be minimal to moderate, and long-term.

Mitigation for noise impacts include use of physical means such as quieter equipment, maintenance of equipment, use of physical noise shields, and muffling of engines, as well as operational means such as scheduling loud equipment to daylight hours, limiting truck hauling hours and positioning noisy equipment as far from sensitive receptors as possible. Mitigation for air quality impacts includes dust suppression methods and maintenance of vehicles, equipment and air filters.

2.0 NEED FOR AND OBJECTIVES OF ACTIONS

2.0 NEED FOR AND OBJECTIVES OF ACTIONS

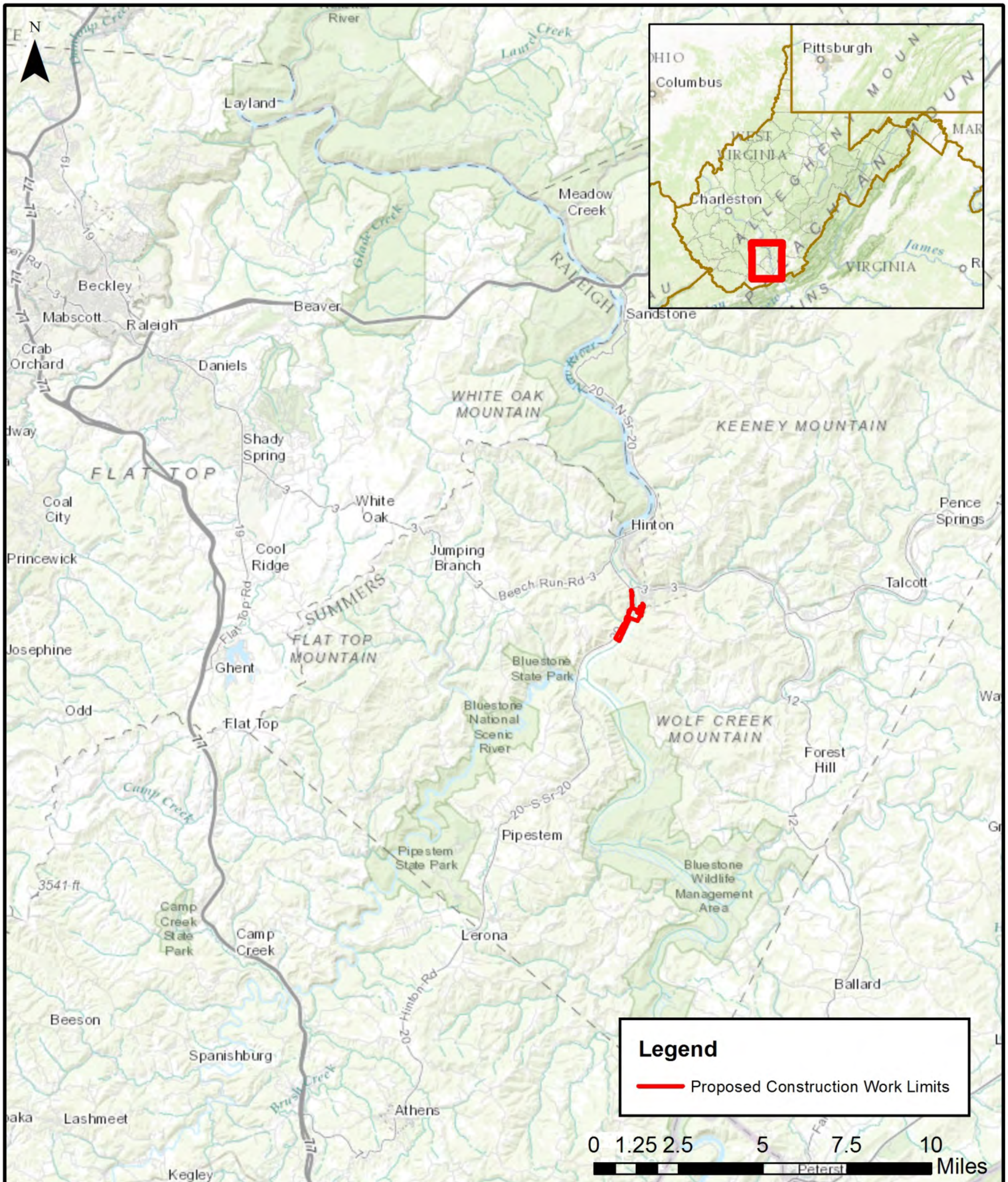
This section describes the Proposed Action and defines the Purpose and Need for the Proposed Action. The background for the project is addressed including the history and authorization for the Bluestone Dam, previous DSA reports, and project area. Applicable regulations for the relevant resources guiding this SDEIS are also included.

2.1 Background

USACE, Huntington District, has prepared this SDEIS to evaluate the potential impacts resulting from additional modifications to reduce the risk of a failure of Bluestone Dam, which is located in Summers County, WV (Figure 2-1). The project area for the Proposed Action is located along the New River corridor. A full array of reasonable alternatives to reduce additional risks and to meet tolerable risk guidelines is evaluated under this SDEIS, which will supplement the 1998 Final FEIS and Record of Decision (ROD). This SDEIS is being prepared in accordance with the National Environmental Policy Act of 1969 (NEPA) and the Council on Environmental Quality's (CEQ) Regulations (40 Code of Federal Regulations [CFR] 1500-1508), as reflected in the USACE's Engineering Regulation (ER) 200-2-2, Procedures for Implementing NEPA.

In the 1990s, USACE determined that Bluestone Dam posed unacceptable risk to public safety and warranted major modifications to maintain a tolerable level. Construction is currently underway to address the dam safety issues identified in the 1998 DSA Report (USACE 1998a), FEIS, and ROD (USACE 1998b). Project construction was approved in 1999 and was initiated in 2000 and was expected to be completed in 2005. The ongoing construction is expected to be completed in 2026 with the majority of the major construction completed in 2019.

During construction of the current DSA project, several risk assessments were performed on Bluestone Dam in accordance with agency regulation, "Safety of Dams – Policy and Procedures" (ER 1110-2-1156 – March 2014). These risk assessments analyzed and measured the probability of a hazard (flood event) occurring, the performance of the dam, and the severity of its consequences. Findings from the latest risk assessment completed in 2016 identified additional dam safety concerns not addressed by the 1998 DSA Report and FEIS. As outlined by ER 1110-2-1156, USACE uses a term called "tolerable risk" to describe the agency's acceptable level of risk for its dams. The risk assessment indicates that the incremental risks well exceed USACE tolerable risk guidelines. These guidelines are further described in Chapter 2.Given the population downstream of Bluestone Dam as well as the identified dam safety issues at the dam, the purpose and need for agency action is to reduce the likelihood of potential failure and its consequences so the dam can continue to safely provide benefits to the nation as originally authorized.



PROJECT LOCATION Bluestone Dam SEIS	ECS - GEC JV
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	Source: ESRI/GEC
	Map ID: 0027970110000-3178

2.2 Site History

2.2.1 Original Project History and Authorization

The Bluestone Dam was originally authorized as a component of a comprehensive flood control plan for the Ohio River while also providing benefits to the communities along the New and Kanawha Rivers. Bluestone Dam is one of three flood risk management dams, along with Sutton and Summersville, built and operated by USACE within the New and Kanawha River watersheds in WV. The dam structure rises 165 feet above the riverbed and spans more than 1,900 feet across the New River, creating the 11-mile long Bluestone Lake upstream of the dam, which is a multipurpose component of the Kanawha River basin system. The dam is designed to slow water as it travels downstream and reduce the chance for out of bank flooding. Excess runoff is stored in Bluestone Lake and the water is slowly released to allow streams and rivers below the dam a chance to recede. The dam helps control a 4,604 square mile drainage area and influences nearly half of the water that flows to Charleston, WV, population of approximately 50,000 people.

Bluestone Dam and Reservoir was authorized by Executive Order (EO) 7183 in 1935 and the Flood Control Acts of 1936 and 1938 for the purposes of flood control, low flow augmentation, and hydroelectric power development. The purposes were later expanded to include recreational activities under the Flood Control Act of 1944 and fish and wildlife enhancement under the Fish and Wildlife Coordination Act (FWCA) of 1958. Recreational opportunities at Bluestone Dam include water related activities such as fishing, boating, water skiing, along with land based recreation like hunting and picnicking. The goals under the FWCA of 1958, to include fish and wildlife conservation, are intended to promote the long-term wellbeing of populations of the plant and animal species native to the project area and the maximum sustained enjoyment of these populations by the public.

More recently, Section 102(ff) of the Water Resource Development Act (WRDA) of 1992, as amended by Section 357 of WRDA 1996, further modified the original project authorization to address the accumulation and disposal of drift and debris at the dam, leading to the addition of the drift and debris removal tower in 2005. Water supply is not an authorized purpose of the Bluestone Dam. However, there is a water supply intake located within the lake that provides water to the greater Princeton, West Virginia area. No other changes to the project purposes are anticipated at this time.

USACE began construction of Bluestone Dam in 1942 following early design and planning activities in the late 1930s. The work continued until 1944 when the War Production Board suspended project construction for the duration of World War II. Construction later resumed in 1946 and the Bluestone Dam was completed for operation purposes in 1949. Installation of the crest gates were later added and installed in 1952. While the original plans and authority for Bluestone Dam called for hydroelectric power development, extensive electric power development during wartime resulted in a decision to defer hydroelectric power development at the project and use all available storage for flood control. This lowered the original intended elevation of the lake 80 feet from 1,490 feet to 1,410 feet during summer pool (April through November), with additional drawdown to 1,406 feet for winter pool (December through March). This drawdown accommodates more flood storage during the winter and early spring months. Note: All elevations are given in the National Geodetic Vertical Datum of 1929 (NGVD 29).

The National Dam Safety Act (Public Law [PL] 92-367) of August 1978 authorized USACE to review its projects for dam safety. The Dam Safety Assurance Program provides for modification of existing USACE projects which may pose potential safety hazards in view of hydrologic and seismic deficiencies evaluated according to current design criteria. It was determined that the Bluestone Dam was eligible for construction modifications due to dam safety issues.

2.2.2 Original EIS and ROD

During the planning of the Bluestone Dam in the 1930s, a hypothetical flood was created by shifting the center of the July 1916 hurricane storm to the New River drainage basin. This hypothetical flood was created based on the best available information at the time. This hypothetical flood served as the basis for the original design of Bluestone Dam which had an estimated peak inflow of 430,000 cubic feet per second (cfs). The hypothetical storm, also known as the Probable Maximum Flood (PMF), is a flood of such magnitude that there is virtually no risk that it will be exceeded and it is the present day standard for design of high-hazard dams. Since the original construction of Bluestone Dam, the PMF has been revised based on the information from the National Weather Service and the most recent methodologies for developing hypothetical storms such as the PMF. The revised PMF has an estimated peak inflow of 1,086,000 cfs, which is more than double the peak of the original design inflow of the dam. A DSA study indicated the Bluestone Dam had a significant hydrological deficiency in that the dam could not safely pass extreme floods without being overtopped. In order to address this hydrologic deficiency, a combined DSA Evaluation Report and FEIS were prepared in 1998 that identified and analyzed the dam safety modifications needed to prevent overtopping. A ROD was signed September 28, 1999.

2.2.3 Dam Safety Assurance Project

The plan approved under the original 1998 decision document was originally formulated to modify Bluestone Dam to safely pass flows of the updated PMF. Primary features of the approved plan included: modification of the six hydroelectric power penstocks to supplement discharge capacity; installation of a parapet wall on top of the dam; construction of an additional gravity monolith on the east abutment; installation of a floodgate closure across WV State Route 20 on the west abutment; adding removable closures at each end of the spillway; installation of high-strength, multi-strand anchors; construction of mass concrete thrust blocks against the downstream face of the dam; and scour protection downstream of the penstocks. In addition, the drift and debris tower was also constructed and made operable in 2005 under the DSA project.

Construction initiated in September 2000 and is currently underway. At the time of the original EIS and ROD, it was assumed that construction would continue for approximately five years and was anticipated to end in 2005. However, construction of the structural features identified in the approved 1998 FEIS were ultimately divided into manageable phases to comply with contracting requirements and annual funding constraints. The DSA project is now anticipated to be completed in year 2026, with the majority of the major construction completed in 2019. The construction phases are briefly described below (Figure 2-2). The analysis in this SDEIS will consider the impacts associated with the newly proposed safety features and the additional construction duration of approximately 20 years.

<u>Phase 1 – Penstocks and Thrust Blocks</u>

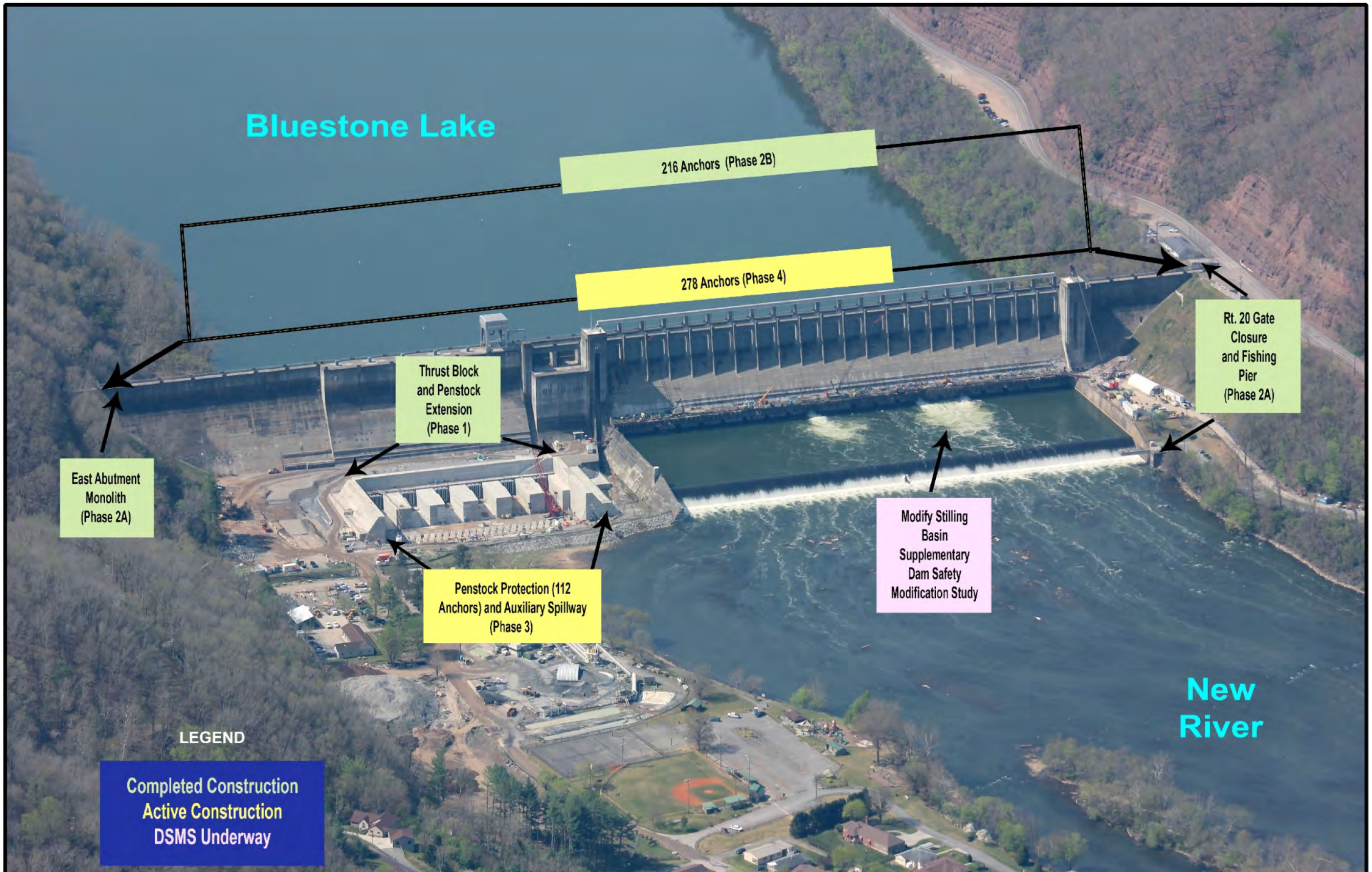
Phase 1 was awarded in 2000 and completed in 2004. Phase 1 included construction of a mass concrete thrust block on the downstream face of monoliths 15 through 21, extension of six steel-lined penstocks through the thrust block, installation of three penstock bulkheads, and a temporary construction access bridge over the stilling basin and penstock area. The thrust block provides additional sliding resistance and the bulkheads allow for additional spillway releases through the penstocks. The temporary access bridge was removed due to safety concerns with high discharges in the stilling basin.

Penstocks

<u>Phase 2A – Miscellaneous Improvements</u>

Phase 2A was awarded in 2004 and completed in 2007. Phase 2A consisted of a swing gate closure across WV Route 20, upgrading the access road to the stilling basin, new east abutment gravity wall monolith, partial parapet wall, crest gate guide extensions, aluminum bulkhead spillway training closures, existing trash chute closure, water tightness modifications, utility line relocations, and an Americans with Disabilities Act (ADA)-accessible fishing pier for mitigation.

Route 20 Closure Gate



BLUESTONE DAM DSA CONSTRUCTION PHASES

Bluestone Dam SEIS

ECS - GEC JV

Figure: 2-2	
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Scale: Not to Scale	
Source: GEC	
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Phase 2B – Anchors


Anchor Installation

Phase 2B was awarded in 2005 and completed in 2011. Phase 2B included the installation of 150 tensioned, high-strength, multi-strand, steel anchors in east abutment monoliths 2-8; non-overflow monoliths 9-15; intake monoliths 16-21; spillway monoliths 25-34, 36, and 38-44; and west abutment monoliths 45 and 47-55. Phase 2B also included completion of the three remaining penstock bulkheads, extensions, and thrustblocks. In 2009, American Recovery & Reinvestment Act (ARRA) funding was secured to install new gallery drains, to clean existing gallery drains, to install 66 additional multi-strand anchors (216 anchors total), and to install eight new piezometers.

Phase 3 – Penstock Stilling Basin


Construction of Penstock Stilling Basin

Phase 3 was awarded in 2010 and completion is expected in 2017. Phase 3 includes construction of a concrete auxiliary stilling basin for the penstocks including an auxiliary stilling basin scour pad and exit pad, two training walls, five divider walls between each penstock, baffles, end sill, and an exit channel. A soil berm with stone protection would be constructed adjacent to the right training wall and the existing right auxiliary to stilling basin training wall would be anchored with tensioned, high-strength, multi-strand, steel anchors.

Phase 4 – Anchors

Phase 4 was awarded in 2010 and completion is expected in 2019. Phase 4 work includes installation of 278 tensioned, high-strength, multi-strand, steel anchors in non-overflow monoliths 10-12, intake monoliths 17-21, assembly bay monoliths 22-23, spillway monoliths 25-44, and west abutment monoliths 45-46. A government furnished platform left from Phase 2B is being used to install the anchors.

Proposed Dam Safety Modification

The dam safety modification will include the recommended and approved plan from the DSMS along with the remaining features approved by the 1998 DSA study that are proven to be feasibly justified, but not yet constructed. The features approved by the 1998 DSA which have not been constructed include 66 multi-strand anchors, completion of the parapet wall, and anchors in the primary stilling basin apron. These features may or may not be implemented depending on the outcome of the DSMS. The DSMS is updating the previous risk assessment based on new hydrological data and has formulated alternatives to address failure modes, for which the SDEIS is based on.

2.2.4 Current Dam Safety Modification Study

When completed, the current modifications under construction that were authorized under the 1998 DSA project will strengthen the dam's stability and allow for increased discharge capacity through the use of hydroelectric power penstocks, thereby substantially reducing flooding and dam failure risk. However, physical modeling and expert analysis conducted during project construction has indicated that the incremental dam safety risks that remain are above the agency's tolerable risk threshold. The 'incremental risk' is the risk which already exists based upon the likelihood and consequences generally to the downstream populations with the presence of the dam. This can be attributed to breach (or dam failure) due to overtopping, defect within the dam or components of the dam which could malfunction. Non-Breach Risk is due to 'normal' dam operation of the dam or overtopping of the dam not considering the breach scenarios. Therefore, incremental risk is the difference in risk in its current state (with dam safety issues and deficiencies) and risks if the dam functions as intended without dam failure (aka non-breach risk). Additional detail on USACE tolerable risk guidelines can be found in ER 1110-2-1156 in Chapter 5.

Multiple risk assessments have been completed over the years since the 1998 study to characterize the dam safety risk associated with Bluestone Dam. The most recent risk assessments were completed and approved in 2016. They are referred to as the Existing Condition Risk Assessment (ECRA) and Future without Federal Action Condition (FWAC) Risk Assessment. These two risk assessments were an update to the 2013 Baseline Condition Risk Assessment report, which indicated that there is an additional potential failure mode not addressed by the 1998 DSA study. This failure mode is associated with spillway monolith instability. The stilling basin is unlined (natural bedrock) and water discharge during the PMF or a significant flood event could cause scour or erosion of the unlined stilling basin and underneath the dam. If scouring or erosion at the downstream toe of the dam occurs, this could cause multiple monoliths to become unstable and slide ultimately leading to dam breach. This failure could occur during extreme events when water would be released over the spillway or due to water overtopping the dam and would likely result in loss of life and additional impacts to the human environment due to increased flooding within highly populated downstream communities.

A DSMS is being conducted in conjunction with this SDEIS that details the performance of the dam given extreme flood and the potential consequences of dam failure to fully understand risks imposed by the Bluestone Dam. The DSMS will explore all reasonable alternatives to address the risks. The Federal objective of the DSMS is to identify and recommend a cost effective alternative risk management plan (RMP) that supports the expeditious reduction of risk in the USACE portfolio of dams. The target for risk reduction is to reduce risk to achieve USACE tolerable risk guidelines (TRG) for annual probability of failure and for average annual life lost, and to consider opportunities to reduce risk to as low as reasonably practicable (ALARP). The DSMS, which is anticipated to be complete in 2017, examines alternatives for reducing risk associated with the risk driving potential failure mode and recommends modifications necessary to ensure the safe performance of the dam as originally intended. The DSMS identified several opportunities to guide the Bluestone DSMS planning process:

- reduce incremental risk associated with dam failure and its consequences to achieve USACE tolerable risk guidelines with structural and/or non-structural measures,
- identify the need for potential studies to reduce non-breach flood risk, and
- re-examine impacts to the human environment and the need for potential mitigation for any identified significant impacts.

As the dam safety issues are considered, objectives and constraints guide the Bluestone DSMS planning process. The primary objective is to identify the most cost effective plan that meets the objectives, to reduce risk to tolerable guidelines. There are also constraints which must be avoided during plan formulation. There are no hard constraints in this study; however there are important planning considerations which, like constraints, influence the planning process. Considerations include:

- impacts to authorized project purposes,
- interim risk increase during implementation,
- significant impacts to environment,
- impacts to high value aquatics,
- impacts on recreational activities,
- social and economic impacts, and
- construction activities that could be detrimental to the stability of the dam structure.

Risk management plans are being analyzed in the DSMS to reduce risk resulting in the plans that achieve tolerable risk guidelines. The target for risk reduction related to Bluestone Dam is to reduce risk to within USACE tolerable risk guidelines for annual probability of failure (APF) and to Average Annual Life Loss (AALL), and to consider opportunities to reduce risk to As Low as Reasonably Practicable (ALARP). AALL is considered to be of paramount importance. Two primary numerical values employed in this study to gauge the condition of Bluestone Dam are APF and AALL or “Risk.” APF is calculated using the *probability of loading* and *probability of failure* given loading. *Probability of loading* is the annual probability that the chosen load range will occur. *Probability of failure given the loading* is the probability that the dam will fail given the specific load or load range. AALL is calculated using risk analysis software and is based on probability of loadings; probability of failures; and the incremental consequences given those associated conditions.

USACE tolerable risk guidelines dictate that APF greater than or equal to 1 in 10,000 (0.0001 or 1×10^{-4}) per year is unacceptable except in extraordinary circumstances. The basis to take action to reduce or better define risk increases as the estimates become greater than (1×10^{-4}) per year. The basis to take action to reduce or better define the risk diminishes as the estimates become smaller than 1 in 10,000 per year. ALARP consideration are also used to evaluate how far to reduce the APF below the guideline.

Life Safety (AALL) - The policy for the estimated AALL under USACE tolerable risk guidelines states as AALL further exceeds 1 in 1,000 (0.001 or 1×10^{-3}) there is increasing justification to invest in risk reduction (i.e. life safety risk above 1×10^{-3} are generally considered unacceptable except in extraordinary circumstances). Likewise, the basis to take action to reduce or better define the risk decreases as the estimates become lower than a 1 in 1,000 chance. AALL less than a 1 in 1,000 chance is considered to be tolerable provided the other tolerable risk guidelines are met. ALARP considerations are used to evaluate how far to reduce risks below the tolerable risk limits until such actions are impractical or not cost effective.

Other risks defined in ER 1110-2-1156 include economic and environmental risk. However, specific tolerable risk guidelines do not exist for evaluation of these risks. Currently the dam safety risk for Bluestone Dam is above the USACE tolerable risk guidelines, therefore action to reduce risk is warranted. The following risk plans have been considered as part of the DSMS to reduce risk:

- modification of the existing stilling basin,
- modification of other dam components,
- construction of an alternative/auxiliary stilling basin,
- construction of an alternative/auxiliary spillway, and
- non-structural measures.

This SDEIS will evaluate the potential impacts to the natural, physical, and human environment as a result of the project. The No Action alternative will also be considered. As required by NEPA and USACE planning guidance, the No Action alternative will form a benchmark from which alternative(s) are evaluated and compared.

2.3 Description of the Proposed Action

The recommended plan, known as the tentatively selected plan (TSP), has been identified that consist of various risk management measures. The TSP reduces incremental risk to tolerable levels and ensures the stability of the stilling basin and dam during extreme flood events. Non-structural risk management measures are included to further reduce consequences of potential dam failure. The Proposed Action, or TSP, is to implement modifications to the existing stilling basin to prevent scour that could result in spillway monolith instability, and thus dam breach or failure, during extreme flood events. The modifications include the following:

Dam Features:

- Anchor placement
- New drainage gallery
- Extension of spillway training walls

First Stage Stilling Basin Features:

- Removal of existing apron
- Installation of a protective concrete overlay in the stilling basin to protect against scour
- Anchor placement
- New larger baffle blocks
- Divider wall
- Stabilization of existing right training wall (no raise) by pouring concrete between the right training wall and the penstocks to protect against scour
- Construction of a concrete slab on the landside of the left training wall (no raise) to protect against scour. This would consist of excavating down to bedrock to place concrete and replace with fill materials back to existing elevation.

Stilling Weir Features:

- Anchor placement
- Dewatering

Second Stage Stilling Basin Features:

- Anchor placement
- Demolition of existing portions of the apron and replacement with heavier reinforcement

Non-structural risk management measures would also be considered part of the TSP. These measures include an enhanced risk communication plan to regularly educate the downstream communities and public of the potential flood risk, emergency procedures, and shared responsibility intended to reduce the overall risk of life and property. The modifications are fully described in the Alternatives Section 3.4. Modifications to the Bluestone Dam would occur over an eight to ten-year period. After construction is completed, USACE does not anticipate any changes from current day-to-day operations of the dam.

2.4 Purpose and Need for the Proposed Action

The purpose of the Proposed Action is to reduce incremental risk associated with dam failure to below the USACE tolerable risk guidelines. The 2016 risk assessments concluded that the downstream bedrock in the stilling basin is vulnerable to erosion during high flow events, resulting in sliding of one or more monoliths causing breach or failure of the dam resulting unacceptable consequences downstream.

The Proposed Action is needed to provide public safety to the communities downstream of the Bluestone Dam. Implementation of the recommended risk management plan, referred to as TSP, would mitigate the intolerable dam safety risk and allow the dam to safely function as originally intended and authorized. Without this action, Bluestone Dam could fail resulting in life-threatening floods on the New and Kanawha Rivers and the lower reaches of the Greenbrier, Gauley, and Elk rivers.

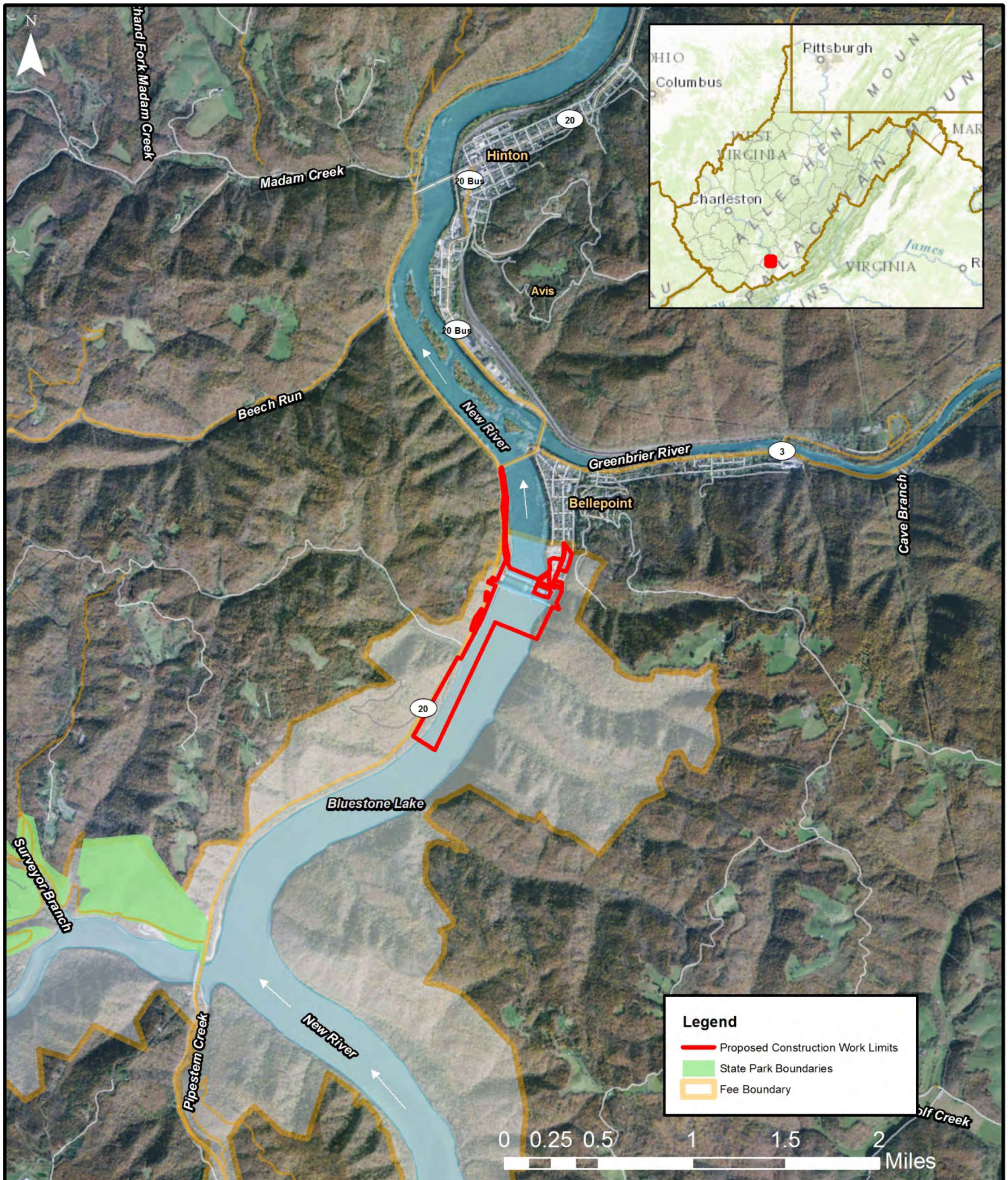
2.5 Project Area

2.5.1 Description of the Project Area

Bluestone Dam is located on the New River along WV State Route 20 within a mountainous region of southern WV in Summers County. The New River is a tributary of the Kanawha River. The dam is approximately one and a half miles upstream of the City of Hinton and a mile upstream of the confluence of the New and Greenbrier Rivers (Figure 2-3). The New River and Gauley River meet at the Town of Gauley Bridge to form the Kanawha River.

The dam and lake derive their name from the Bluestone River, which joins the New River about two miles above the dam. Bluestone Lake is approximately 11 miles in length at normal pool and is located upstream of the dam and includes the rivers and streams above the lake. Bluestone Lake lies predominantly in Summers County, WV, with some portions in Monroe and Mercer Counties, WV, and Giles County, Virginia. At the lake's maximum flood control pool, the lake extends approximately 36 miles upstream from the dam. At summer pool elevation of 1,410 feet above mean sea level, the lake extends 10.7 miles behind the dam and covers 2,040 acres. At winter pool elevation of 1,406 feet, the lake extends 9.5 miles and covers 1,800 acres. The upstream area is part of a large drainage basin encompassing 4,565 square miles. A large portion of the New River near the Bluestone Dam has been designated by Congress as a Wild and Scenic River and 13 miles of the lower Bluestone River have been designated as a National Scenic River.

The area extending from the Bluestone Dam towards the mouth of the Ohio River is considered the downstream area. The New, Greenbrier, Gauley, Elk, and Kanawha rivers are the major rivers below Bluestone Lake. There are small communities and rural residences located between the towns of Hinton and Gauley Bridge. Below Gauley Bridge, the river valley becomes more urban and commercialized and the valley floor, from the Fayette County-Kanawha County line to Poca in Putnam County, is a heavily populated industrial belt containing numerous plants, as well as extensive residential and commercial development. Several of the medium to large communities in the area include Montgomery, Chesapeake, Belle, Charleston, South Charleston, Institute, St. Albans, and Nitro. The New River Gorge National River is a 50-mile river segment that was designated in 1978 and extends from the northern edge of Hinton to just below the U.S. Route 19 bridge, near Fayetteville, WV. Refer to the 1998 FEIS for detailed descriptions of the upstream and downstream characteristics of the dam.



VICINITY MAP

Bluestone Dam SEIS

ECS - GEC JV	
Figure: 2-3	
Date: May 2016	
Scale:1:45,000	
Source: ESRI/GEC	
Map ID: 0027970110000-3178	

2.5.2 Description of the Bluestone Dam and Current Operations

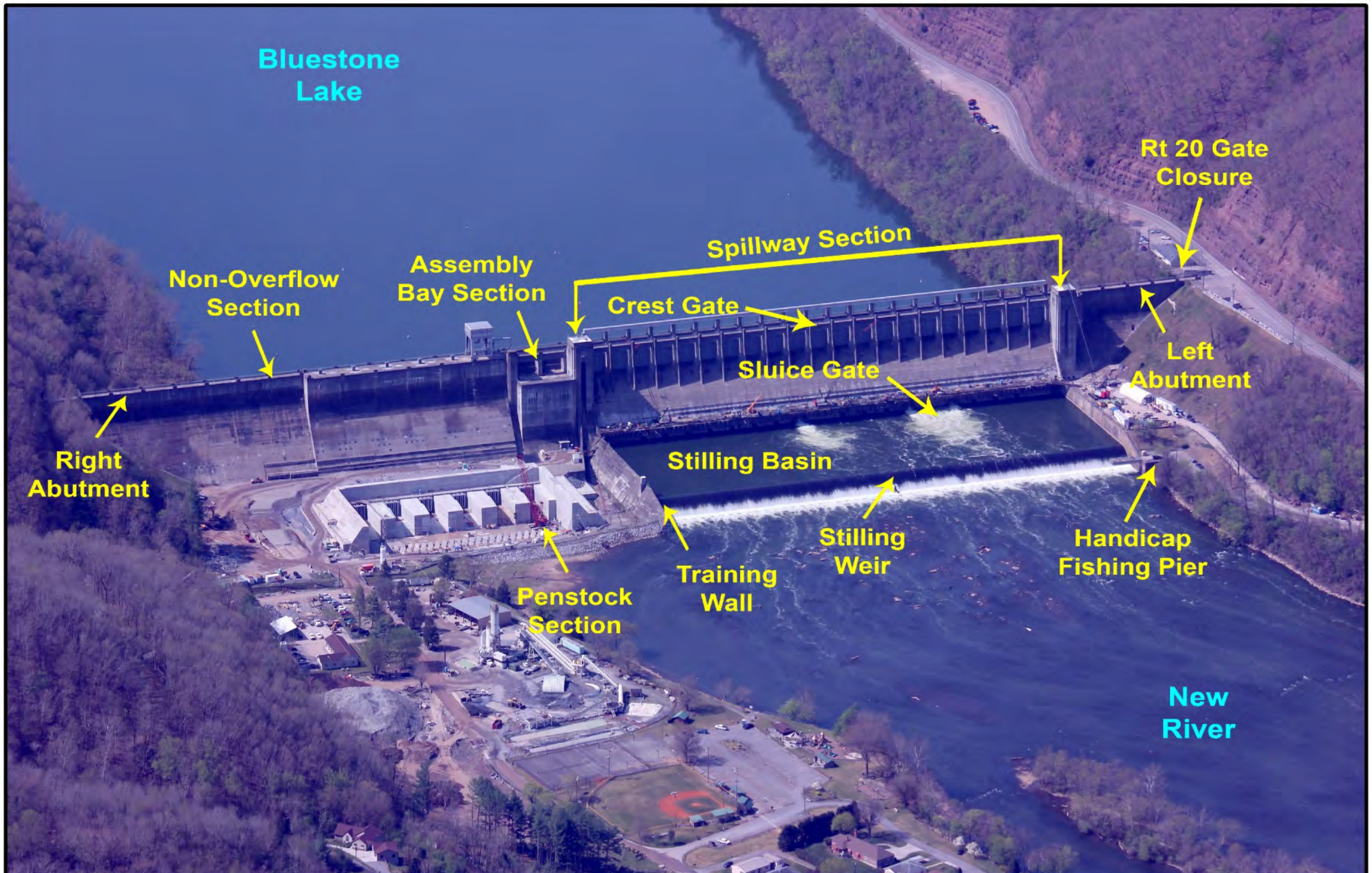
Bluestone Dam is a straight, concrete, gravity structure which was lengthened to an overall length of 2,061 feet during the ongoing dam safety modifications (Figure 2-4). The top of the dam elevation is at 1,535 feet and the maximum height of the dam is 165 feet above the streambed. The dam is designed to retain flood waters up to elevation 1,520 feet, or nearly 120 feet above summer pool, if necessary. The dam originally relied on its own dead weight to resist the hydrostatic pressure from water, or the pressure exerted by water in the reservoir behind the dam on the upstream side. The recent installation of the tensioned, high-strength, multi-strand, steel anchors assist in relieving some of the hydrostatic uplift pressure on the dam.

The discharge capacity of the existing structure is accomplished through gated sluices, which control the water level and flow rate in the river, located at the base of the dam and a gated auxiliary spillway along the face of the dam. A spillway is a structure used to provide the controlled release of flows from the dam into the downstream area and release floods so that the water does not overtop and damage the dam. Except during flood events, water does not normally flow over the spillway. The spillway section is 790 feet long with a crest elevation at 1,490 feet. The spillway flow is controlled by 21 vertical lift crest gates that control the discharge of excess floodwater storage. These crest gates can discharge large volumes of water to avoid overtopping of the dam. Normal release of water from the lake is through the 16 gated sluices with a maximum total discharge capacity of 72,000 cfs at pool elevation of 1,517 feet with no spillway crest gate flow. A 797-foot long stilling basin is maintained directly below the dam by a 23-foot high concrete weir located 364 feet downstream from the axis of the dam. A weir is a low dam or overflow structure. The stilling basin functions to dissipate the energy created by the discharging of the water through the gates. There are double rows of baffles located on the apron of the dam and immediately below the stilling weir to further dissipate energy. Two training walls are located to the left and right of the stilling basin and serve to keep the discharged water within the stilling basin.

The dam has two non-overflow abutments (left and right) that are not designed to discharge water. The assembly bay section contains the electrical and maintenance equipment along with the main office. The penstock section contains the six penstock tunnels that were originally constructed for hydroelectric turbines to be added once the dam was utilized for hydroelectric power. The penstock section is currently being modified to allow for excess discharge, if necessary, while still maintaining the ability for hydroelectric power use in the future. Refer to the 1998 FEIS for a detailed description of the components and features of the dam.

2.5.3 Definition of the Study Area

The original 1998 FEIS defined four reconnaissance areas for discussion of impacts (Figure 2-5):

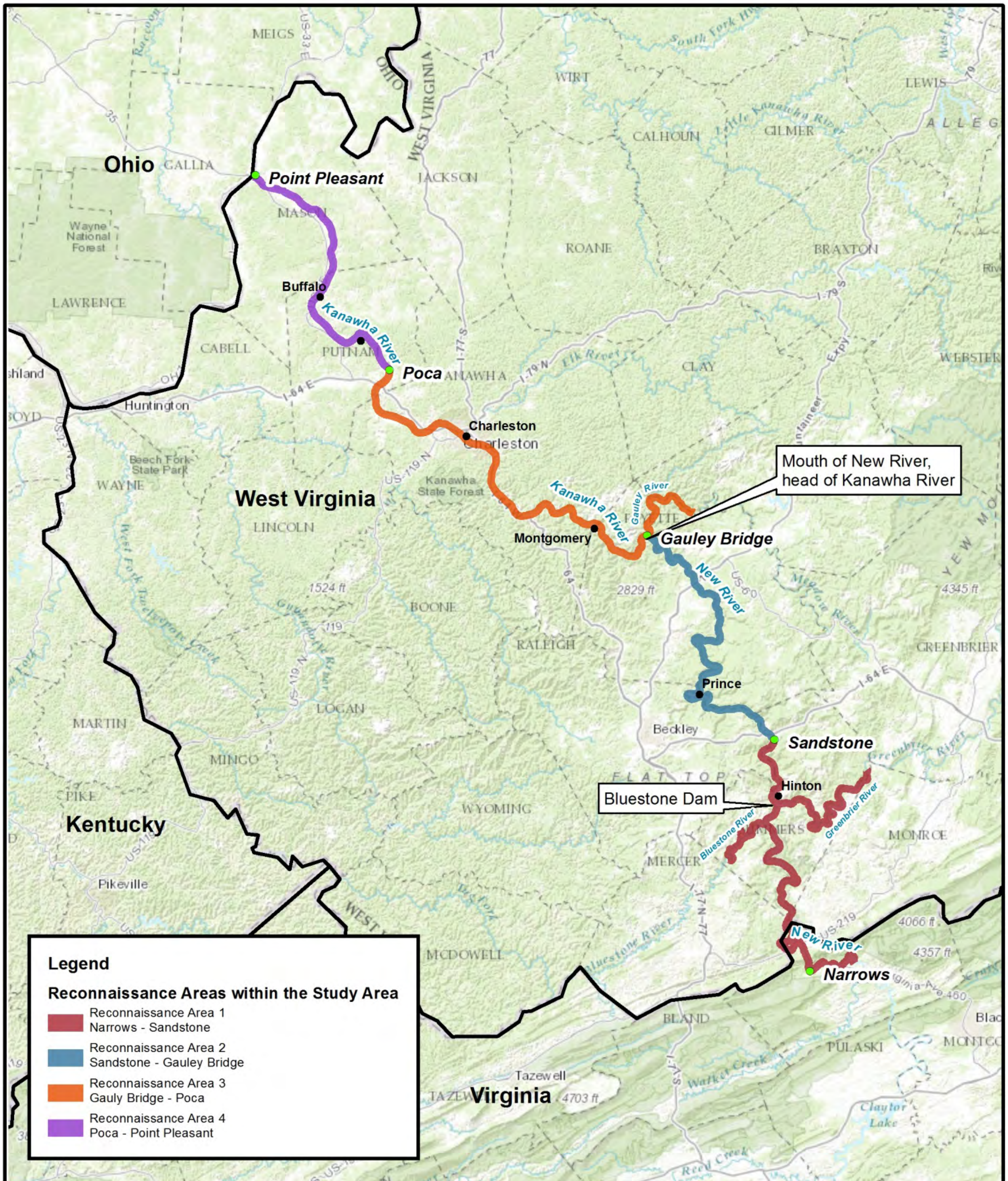


EXISTING BLUESTONE DAM FEATURES

Bluestone Dam SEIS

ECS - GEC JV

Figure: 2-4
Date: June 2016
Scale: Not to Scale
Source: GEC
Map ID: 0027970110000-3178



STUDY AREA

Bluestone Dam SEIS

ECS - GEC JV

Figure: 2-5

Date: June 2016

Scale:1:1,400,000

Source: ESRI/GEC

Map ID: 0027970110000-3178

Reconnaissance Area 1 encompasses the area upstream of the Bluestone Dam from just south of Bluff City, VA, and downstream past the dam to Sandstone, WV. It includes many recreational resources including the Bluestone Wildlife Management Area, Bluestone State Park, the Upper New Wild and Scenic River, the southern tip of the New River Gorge National River and the Bluestone National Scenic River. Reconnaissance Area 1 includes the communities of Narrows, Rich Creek, and Glen Lyn, VA, and Hinton, WV.

Reconnaissance Area 2 extends from Sandstone to Gauley Bridge, WV. There are no large communities along the New River within this area. Reconnaissance Area 2 lies within boundaries of the New River Gorge National River. The former Grandview State Park (now part of the New River Gorge National River) and Hawks Nest State Park are also in this area. Meadow Creek, Ansted, and the historic town of Thurmond all lay within Reconnaissance Area 2.

Reconnaissance Area 3 extends from Gauley Bridge to Poca, WV. It encompasses many towns and cities, including portions of Charleston, and the heavily industrialized Kanawha River valley, with the major industries consisting of chemical manufacturers and processors.

Reconnaissance Area 4 extends from Poca to Point Pleasant, WV. The region along the river is more rural with development widely scattered. Towns in Reconnaissance Area 4 include Winfield, Buffalo and Point Pleasant, as well as several smaller communities.

For the purposes of this SDEIS, most resource impacts would be limited to Reconnaissance Areas 1 and 2. These combined areas extend from the New River near Bluff City, VA to Gauley Bridge, WV.

2.6 Public Involvement Process

2.6.1 Scoping Process

USACE conducted an early and open process to inform the public and regulatory agencies about the project, and to determine the scope and significance of issues to be addressed in the SDEIS. The scoping process enables USACE to gather information concerning sensitive resources from regulatory agencies and determine the public's major concerns. A Notice of Intent (NOI) for the SDEIS was prepared by the Huntington District and was published in the Federal Register November 25, 2013, and in local newspapers (Appendix A). This NOI publicly disclosed and described the project that would be analyzed in this SDEIS. A public scoping meeting was conducted by the Huntington District on December 5, 2013 to gain input from interested agencies, organizations, and the general public concerning the content of the SDEIS, issues and impacts to be addressed in the SDEIS, and alternatives that should be analyzed. The meeting/workshop was held at the Summers County Memorial Building in Hinton, WV. The presentation of the scoping meeting can be found in Appendix A. The presentation included a project overview including major components of the

Bluestone Dam, history of dam safety construction including construction phases, the dam safety modification study, and the study process. The workshop had stations set up for participants to visit including a problem station that included information on current problems with the dam; a fixes station that described various alternatives to remedy the current safety issues with the dam; a study station that included information on the planning process; an environmental station where environmental staff could answer questions on potential environmental impacts; a flooding consequences station that included inundation maps; and a court reporter station for participants make comments for the record.

2.6.2 Public Hearing

USACE is committed to holding public hearings regarding the SDEIS. The SDEIS will be circulated for a 45-day public review and comment period. A Notice of Availability (NOA) of the SDEIS will be published in the local newspapers.

2.6.3 Public Concerns

Public comments are solicited during public scoping and in response to the SDEIS. Comments received during the public scoping meeting can be found in Appendix A and included:

- Two anonymous comments were received from the public during the public scoping meeting. One comment was oral and was regarding construction traffic using roadways through Bellepoint. The second comment was written and was regarding the impact on the community from prolonged construction, noise and dust, and replacement of the ballpark in Bellepoint which had been removed and the space utilized for construction staging during the ongoing dam modifications.

- Four written comments were received from agencies including City of Charleston, NPS, WV Division of Culture and History, and WVDNR.

2.6.4 Coordination

Federal, state, and local agencies with responsibility, authority, and interests related to the Bluestone Project area and other affected areas were notified. A mailing list can be found in Appendix A. Discussions with these agencies were held as part of the scoping process.

An interagency meeting was held on May 31, 2016. The goal was to discuss the dam safety assurance program project plan in detail, to solicit technical advice, and to identify and consider concerns for subsequent inclusion in the SDEIS.

Agencies consulted during the NEPA process included:

Federal Agencies:
- U.S. Fish and Wildlife Service (USFWS)
- U.S. Environmental Protection Agency, Region III (USEPA)
- U.S. National Park Service (NPS)

State Agencies:
- WV Department of Natural Resources (WVDNR)
- WV Department of Environmental Protection (WVDEP)
- WV State Historic Preservation Office (WV SHPO)

Local Agencies:
- City of Hinton, WV
- West Virginia Rafting Association

2.7 Prior Reports

Information and data on the existing Bluestone Dam and surrounding area conditions associated with the Proposed Action were derived from the following reports, and are incorporated herein as reference:

- 1999, Final EIS and ROD, Bluestone Lake Dam Safety Assurance Program. This document discussed impacts from the Bluestone Dam modifications necessary to withstand the PMF event as authorized in the National Dam Safety Act. The proposed modifications would reduce risk of catastrophic downstream losses associated with dam failure during extreme flooding. The SDEIS is a supplement to this original 1999 EIS.

- 2014, Final Planning Aid Letter for the Bluestone Dam Safety Project. This document was prepared by USFWS and its purpose is to describe the current baseline condition of fish, wildlife, and plant resources in the area; identify high value resources and habitats; provide a preliminary analysis of the effects of the proposed measures to modify the dam; and provide preliminary recommendations on avoidance, minimization, and mitigation measures.

- 2016, Draft Mitigation Plan for the Bluestone Dam Safety Project. This purpose of this document is for USFWS to provide guidance to USACE early in the planning process so that more detailed mitigation plans can be developed and incorporated into the SDEIS.

- 2016, Draft Fish and Wildlife Coordination Act Report. This document was prepared by the USFWS for USACE and its purpose is to address fish and wildlife resource impacts associated with implementing the proposed project and provide mitigation recommendations for impacts to those resources.

- 2016, Draft Bluestone Dam Risk Assessment and Technical Summary and Dam Safety Modification Report. This document presents the dam safety risk assessment for Bluestone Dam. It is the beginning stages of a DSMS and its intent is to present the investigation, documentation, and rationale for the need of dam safety modifications at the Bluestone Dam. The DSMS, which is scheduled to be finalized in 2017, will document the rationale for the recommended safety modifications to address the risk associated with a failure at Bluestone Dam. The Draft DSMS initiated the need for this SDEIS.

2.8 Permit, Licenses, and Entitlements Required

2.8.1 Applicable Federal Statutes and Regulations

A preliminary review was performed to determine the applicability of Federal and State regulations to the Proposed Action. Based on that analysis of applicability, regulations were reviewed to conform to guidelines for compliance requirements. Key requirements are summarized in the following sections.

Archaeology, Historic, and Scientific Preservation (36 CFR, Part 800): The National Historic Preservation Act of 1966, Section 106, requires that Federal agencies "take into account" how each undertaking could affect historic properties located in the impact zone. For purposes of Section 106, any property listed in, or eligible for, the National Register of Historic Places is considered historic. It is important to note that the protections of Section 106 extend to properties that possess significance, but have not yet been listed or formally determined eligible for listing. Even properties that have not yet been discovered, such as archaeological properties, but that pose significance, are subject to Section 106 review. The standard review process involves five steps:

- identify and evaluate historic properties;
- assess effects of proposed action;
- consult with the State Historic Preservation Office (SHPO);
- consult with Council on Historic Preservation; and,
- proceed according to a memorandum of agreement.

Under the Archaeological and Historic Preservation Act (ARPA) of 1974, the Department of the Interior establishes procedures for preservation of historic and archaeological data that might be destroyed through alteration of terrain as a result of a Federal construction project or a federally licensed activity or program (16 USC 469).

ARPA of 1979 (PL 96-97) enhanced the permitting requirements stated in the Antiquities Act of 1906 and establishes that archaeological resources on public lands are part of the Nation’s heritage and should be preserved for the benefit of the American people. Unauthorized excavation, removal, damage, or alteration of any archaeological resource on public lands is prohibited.

The purpose and intent of the Native American Graves Protection and Repatriation Act (NAGPRA) (PL 101-601) is to acknowledge the ownership of certain human remains, funerary objects, and sacred artifacts by Native American tribes. This Act's implementing regulations are found in 43 CFR Part 10 and requires federal agencies and museums receiving federal fund to inventory collections of human remains and associated funerary objects.

Endangered Species Act (16 USC 1531 *et seq.*): In accordance with Section 7(a)(2) of the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*) (ESA), Federal agencies are required to ensure that any actions they carry out, fund or authorize are not likely to jeopardize the continued existence of federally listed threatened or endangered species or result in destruction or adverse modifications of the critical habitat of such species. If the Federal agency determines that its proposed action may affect federally listed species or critical habitat, it must consult with the USFWS. Also, USACE gives consideration to State-listed sensitive species by reviewing proposed actions to assure adverse impacts are avoided when possible. Under Section 7(a), Federal agencies must consult with the Department of the Interior and its USFWS. For marine species, Federal agencies must also consult with the National Marine Fisheries Service to ensure that remedial actions do not jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their critical habitat.

Environmental Justice in Minority and Low-Income Populations: Executive Order (E.O.) 12898 directs Federal agencies to address the disproportionately high and adverse human health or environmental effects of their actions on minority or low-income populations, to the greatest extent practicable and permitted by law. The EO is intended to promote nondiscrimination in Federal programs that affect human health and the environment, as well as provide minority and low-income communities access to public information and public participation.

Fish and Wildlife Coordination Act (16 USC 661 *et seq.*): The Fish and Wildlife Coordination Act (FWCA) requires that actions be taken to protect fish and wildlife that may be impacted by diversion, channeling or other activities that modify a river or stream (16 USC 662). Specifically, the F&WCA, along with the Conservation Act and other advisories, requires Federal agencies issuing a permit to modify any offsite body of water to consult with Federal and State wildlife agencies to ensure that resources are appropriately protected. Coordination with a number of Federal and State agencies would be necessary for those alternatives which may impact area water bodies to prevent, mitigate, or compensate for project-related losses of fish or wildlife.

Floodplain Management and Protection of Wetlands (40 CFR Part 6, Appendix A): USEPA policy for carrying out the provisions of Executive Orders 11988 (Floodplain Management) and 11990 (Protection of Wetlands) are set forth in 40 CFR Part 6, Appendix A. These policies are discussed below.

- *Floodplain Management*. EO 11988, requires that Federal agencies proposing activities in a floodplain must consider alternatives to avoid long- and short-term adverse impacts associated with occupancy and modification of floodplains and incompatible development in the floodplains. If no practicable alternatives exist to siting an action in a floodplain, the action must be designed to minimize potential harm to or within the floodplain. Agencies responsible for providing Federal assistance for construction and improvements and for conducting programs affecting land use must take actions to accomplish the following:

  - Reduce the risk of flood loss;
  - Minimize the impacts of floods on human safety, health and welfare; and,
  - Restore and preserve the natural and beneficial values served by floodplains.

These requirements could be potentially applicable if Federal funds are used (e.g., Federal lead on remedial actions or mixed funding).

Most of the requirements associated with the order are set forth in the "Floodplain Management Guideline," published February 10, 1978, by the Water Resource Council to aid Federal agencies in complying with the order. These guidelines include alternative evaluation, impact assessment and mitigation, and public involvement that are already incorporated into the feasibility study process.

- *Protection of Wetlands*. EO 11990, as amended by EO 12608, directs Federal agencies to take actions to minimize the destruction, loss, or degradation of wetlands. Federal agencies must avoid, to the extent possible, long- and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands if practicable alternatives exist. To preserve and enhance the natural and beneficial values of remediation, potential wetlands in the area must be evaluated. The justification and mitigation for all impacts on waters of the U.S. (WUS), including wetlands, involves first trying to avoid impacts on the resource, secondly minimizing impacts on the resource, and thirdly providing compensatory mitigation for all unavoidable impacts on WUS, including wetlands and other waters. Avoidance is determined first by demonstrating that the proposed project is water dependent, and secondly by demonstrating that the proposed project is the least environmentally damaging practicable alternative.

  Wetlands are defined as "areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas." (33 CFR 323.2(c)).

National Environmental Policy Act (40 CFR 1500-1508; 33 CFR, Parts 230 and 235): NEPA, signed into law on January 1, 1970, established a national policy to strive for beneficial use and improvement of the environment without degradation. The Act set forth a comprehensive Federal environmental policy and a process for environmental review of all major Federal actions in light of environmental goals and needs. Section 102C of the Act calls for the preparation of a detailed EIS as a major part of this process whenever it is determined that the action has a potential to cause significant adverse impact on the quality of the human environment. In 1978, the CEQ adopted regulations (40 CFR 1500-108) to strengthen and focus the NEPA/EIS process. The emphasis of the CEQ regulations is to establish uniform procedures for the implementation of NEPA, to reduce paperwork, to minimize delays, and to improve decision making. Section 1507.3 requires each Federal agency to adopt procedures to implement NEPA in accordance with the requirements of the regulations. The USACE regulations are found in 33 CFR, Parts 230 and 235. The overall objective of the NEPA process is to ensure that adequate consideration is given to environmental factors in carrying out Federal actions. The elements of the process include consideration of these factors early in the planning effort. A systematic interdisciplinary approach to environmental analyses and the development and evaluation of alternatives ensures the mitigation of adverse impacts, and involves the public and governmental officials in the review and decision-making process.

Section 404 of the Clean Water Act: Under Section 404(b)(1) of the Clean Water Act (CWA), an evaluation must be prepared to assess the impacts associated with the discharge of dredged and fill materials into WUS, including wetlands. Full compensatory mitigation would be required for the unavoidable adverse impacts on wetlands resulting from the project.

Wild and Scenic Rivers Act: The Wild and Scenic Rivers Act (PL 90-542), establishes a framework whereby the nation's outstanding rivers and streams may be permanently protected for the benefit of present and future generations. The National Park Service (NPS) administers the program.

2.8.2 Relevant Resources

Table 2-1 lists the relevant resources that are assessed in this SDEIS. Their importance institutionally, technically, and publicly are also described.

Table 2-1. Relevant Resources

Resource	Institutional Importance	Technical Importance	Public Importance
Geology and Soils	Farmland Protection Policy Act of 1981; Food Security Act of 1985, as amended; Soils Conservation Act	The potential for a project component to result in on- or off-site lateral spreading, subsidence, liquefaction, or collapse. Provides the potential provision of forest products and human and livestock food products. Compliance requires coordination with the Natural Resources Conservation Service to determine if any designated prime or unique farmlands are affected.	People or structures can be exposed to loss, injury or death if a geologic unit is not properly considered during design.
Wetland Resources	Clean Water Act of 1977, as amended; EO 11990 of 1977 as amended by EO 12608, Protection of Wetlands; Coastal Zone Management Act of 1972, as amended; and the Estuary Protection Act of 1968, EO 11988, and Fish and Wildlife Coordination Act of 1958.	Provide necessary habitat for various species of plants, fish, and wildlife; they serve as ground water recharge areas; provide storage areas for storm and flood waters; serve as natural water filtration areas; provide protection from wave action, erosion, and storm damage; and provide various consumptive and non-consumptive recreational opportunities. Compliance requires the results of analysis and findings related to wetlands be included in the SDEIS.	The general public places a high value on the functions and values that wetlands provide. Environmental organizations and the public support the preservation of marshes.
Floodplains	EO 11988 (Floodplain Management)	Federal and state agencies are required to avoid direct or indirect support of development within the 100-year floodplain whenever there is a practicable alternative. Compliance requires as assessment and evaluation together with other general implementation procedures	The public is concerned about the development in floodplains and subsequent flooding.

Resource	Institutional Importance	Technical Importance	Public Importance
		to be incorporated into the SDEIS.	
Aquatic Resources/ Fisheries	Fish and Wildlife Coordination Act of 1958, as amended. State policies may apply as well.	Critical element of many valuable freshwater and marine habitats; an indicator of the health of the various freshwater and marine habitats; and many species are important commercial resources. Compliance requires coordination with the USFWS and WVDNR.	The public places a high value on aesthetic, recreational, and commercial resources.
Water Quality	Clean Water Act of 1977, Fish and Wildlife Coordination Act, Coastal Zone Management Act of 1972, Wild and Scenic Rivers Act, and WV Pollution Control Act (WPCA) 2014, Section 10 of the Rivers and Harbors Act	USACE, USFWS, National Marine Fisheries Service (NMFS), NRCS, USEPA, WVDEP, and WVDNR recognize value of fisheries and high water quality. National and state standards established to assess water quality. Compliance requires preparation of 404(b)(1) evaluation and submission of such to Congress with the SDEIS; and issuance of Section 401 water quality certification and National Pollutant Discharge Elimination System by WVDEP. Compliance also requires coordination with Department of the Interior to determine if any designated or potential wild, scenic, or recreational rivers are affected by the project.	Environmental organizations and the public support the preservation of water quality and fishery resources and the desire for clean drinking water.
Terrestrial Resources	Fish and Wildlife Coordination act of 1958, as amended; EO 13112 Invasive Species.	Provides habitat provided for both open- and forest-dwelling wildlife. Compliance requires coordination with the USFWS and WVDNR and an assessment of the potential for the project to introduce invasive species to the project area.	The public places high priority on the present economic value or potential for future economic value.

Resource	Institutional Importance	Technical Importance	Public Importance
Wildlife	Fish and Wildlife Coordination Act of 1958, as amended and the Migratory Bird Treaty Act (MBTA) of 1918	Critical element of many valuable aquatic and terrestrial habitats; an indicator of the health of various aquatic and terrestrial habitats; many species are important commercial resources. Compliance requires coordination with the USFWS and WVDNR.	The public places high priority on their aesthetic, recreational, and commercial value.
Threatened and Endangered Species	The Endangered Species Act of 1973, as amended; the Marine Mammal Protection Act of 1972; and the Bald Eagle Protection Act of 1940.	USACE, USFWS, NMFS, NRCS, USEPA, and WVDNR cooperate to protect these species. The status of such species provides an indication of the overall health of an ecosystem. Compliance requires coordination with USFWS and/or NMFS to determine if any endangered or threatened species or their critical habitat would be impacted by the project.	The public supports the preservation of rare or declining species and their habitats.
Recreational Resources	Federal Water Project Recreation Act of 1965 as amended and Land and Water Conservation Fund Act of 1965 as amended	Provide high economic value to local, state, and national economies.	The public places a high on value on publicly available fishing, hunting, and boating areas.
Cultural Resources	National Historic Preservation Act of 1966, as amended; the Native American Graves Protection and Repatriation Act of 1990; and the Archaeological Resources Protection Act of 1979	State and Federal agencies document and protect sites. Their association or linkage to past events, historically important persons, and design and construction values; and for their ability to yield important information about prehistory and history. Compliance requires USACE to undertake recovery, protection, and preservation of significant cultural resources whenever activities may cause	Preservation groups and private individuals support protection and enhancement of historical resources.

Resource	Institutional Importance	Technical Importance	Public Importance
		irreparable loss or destruction of such resources and to take into account the impacts of a project on any property included in or eligible for inclusion in the National Register of Historic Places. Compliance would be achieved with SHPO concurrence.	
Transportation	Federal Highway Administration	Provide high value to local, state, and national economies.	The public places high priority on transportation systems and traffic loads.
Hazardous, Toxic, and Radioactive Waste	Resource Conservation and Recovery Act of 1976, as amended by Hazardous and Solid Waste Amendments of 1984; Comprehensive, Environmental Response, Compensation, Liability Act of 1980, as amended by Emergency Planning and Community Right to-Know Act of 1986	State and Federal agencies recognize the value of a clean environment. National and state standards established to assess contamination. Compliance requires an HTRW assessment to identify sites of concern in the project area and vicinity.	Virtually all citizens express a desire for a clean environment.
Noise	Noise Control Act of 1972, as amended by Quiet Communities of 1978.	National and state standards established to assess noise levels. Compliance with surface carrier noise emissions.	Citizens are concerned about exposure to noise levels due to health reasons and annoyance.
Air Quality	Clean Air Act of 1963, as amended and WV Pollution Control Act.	State and Federal agencies recognize the status of ambient air quality in relation to the NAAQS. Compliance requires coordination with USEPA and analyses of potential impacts on air quality and climate change.	Virtually all citizens express a desire for clean air.
Aesthetics	USACE ER 1105-2- 100, and National Environmental Policy Act of 1969, the Wild and Scenic	Visual accessibility to unique combinations of geological, botanical, and cultural features that	Environmental organizations and the public support the preservation of natural pleasing

Resource	Institutional Importance	Technical Importance	Public Importance
	Rivers Act, and the National and Local Scenic Byway Program	may be an asset to a study area.	vistas.
Socio-Economics	River and Harbor Flood Control Act of 1970 (P.L. 91-611), Section 122, Water Resources Development Act of 2007.	Federal projects must provide an economic benefit to the U.S. public. Community cohesion and long-term economic growth is important for maintaining community viability.	Social concerns and items affecting area economy are of significant interest to community.
Environmental Justice	EO 12898 (Environmental Justice in Minority and Low-income populations); EO 13045 (Protection of Children from Environmental Health Risks and Safety Risks); and the Department of Defense's Strategy on Environmental Justice of 1995.	The social and economic welfare of minority and low income populations may be positively or disproportionately impacted by the TSP. Compliance requires assessment of project effects on minority and low-income populations and environmental health and safety risks that may disproportionately affect children.	Public concerns about the fair and equitable treatment (fair treatment and meaningful involvement) of all people with respect to environmental and human health consequences of Federal laws, regulations, policies, and actions.

3.0 ALTERNATIVES INCLUDING PROPOSED ACTION

3.0 ALTERNATIVES INCLUDING PROPOSED ACTION

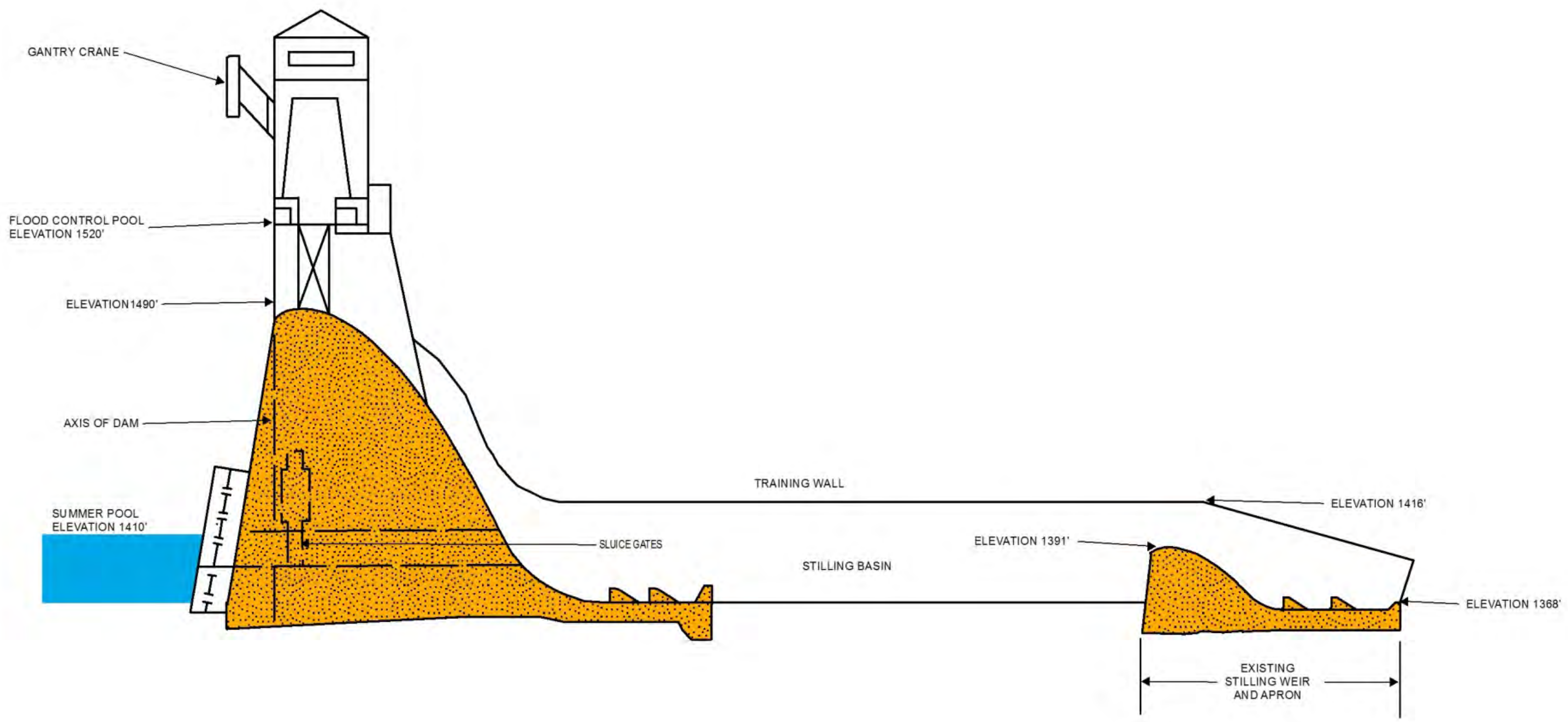
This section describes the array of alternatives considered to address the significant hydrologic deficiency and the resulting potential failure mode described in Section 2.2.4. The alternatives considered consist of various approaches to modifying the existing stilling basin to prevent scour that could result in spillway monolith instability, and thus dam failure, during extreme flood events. This section provides an overview of the plan formulation and screening process conducted to determine the alternative plans to be carried forward for analysis and summarizes the major features of these alternative plans.

The existing stilling basin consists of a two-stage “hydraulic jump” basin (Figure 3-1). The fundamental concept behind such a design is that when fast-flowing water enters an area of slower water, it produces what is referred to as a “hydraulic jump,” which serves to dissipate the faster-flowing water’s energy. Bluestone’s existing concrete stilling weir, located approximately 250 feet downstream of the dam, serves to slow and pool water released through the dam’s sluice and crest gates. The energy of the fast-moving water released through the sluice and crest gates is reduced when it falls onto baffle blocks and enters the area of pooled, slower water between the dam and the stilling weir. Water within this first pool flows evenly over the stilling weir, falling onto one set of baffles and flowing through a second set, which further dissipates the water’s kinetic energy, disrupts the plunging path of the water and reduces scour due to erosive forces. Training walls along both sides of the stilling basin contain the hydraulic jump and high velocity flows within the basin.

Between the dam and the stilling weir, a large portion (approximately 180 feet) of natural riverbed lacks overlay protection (e.g., concrete apron), and thus is subject to scour due to erosive forces within the stilling basin. The alternatives considered are intended to address this primary potential mode of erosion and scour downstream in the stilling basin and the displacement of downstream rock near the dam foundation increasing the risk of sliding failure; along with other known facets of failure mechanisms such as uplift pressure.

3.1 Discussion and Evaluation of All Reasonable Alternatives

Engineering Regulation (ER) 1110-2-1156 provides policy and procedures for Dam Safety Modification Studies. According to ER 1110-2-1156, the first phase of the plan formulation process for studies such as the Bluestone Dam Modification Study is the identification of dam safety risk management measures that could be implemented, giving consideration to structural and non-structural measures, to address the potential failure mode of concern. Non-structural measures reduce risk by focusing on reduction of the consequences of floods, whereas structural measures focus on reducing the probability of flooding. The second phase is the formulation of alternative risk management plans by combining the possible risk management measures.



EXISTING BLUESTONE DAM CROSS-SECTION

Bluestone Dam SEIS

ECS - GEC JV

Figure: 3-1	
Date: June 2016	
Scale: Not to Scale	
Source: GEC	
Map ID: 0027970110000-3178	

In order to develop a final array of actionable alternatives to reduce risk for Bluestone Dam, a number of measures were initially considered, screened, and formulated into the following array of alternative plans. Each of these plans includes continued risk communication with the potentially impacted communities and users about potential risk, which is a non-structural measure. Reasonable alternative plans include:

- No Action
- Remove Dam
- Replace Dam
- Basin with Supercavitating Baffles
- Downstream Conventional Stilling Basin
- Transitional Flip Basin
- Concrete Overlay of Exposed Rock in Stilling Basin

3.2 Alternatives Considered but Eliminated

The array of alternative plans was screened using a set of screening criteria, based in part on USACE planning guidance laid forth in Planning Regulation ER 1105-2-100. This screening process considered the following criteria:

- Effectiveness (Incremental Risk Reduction): is the extent to which an alternative risk management plan contributes to achieving the planning objectives of reducing incremental risk.
- Efficiency: is the extent to which an alternative risk management plan is the most cost effective means of achieving the objectives.
- Acceptability: is the extent to which an alternative risk management plan is acceptable in terms of applicable laws, regulations, and public policies.
- Completeness: is the extent to which an alternative risk management plan provides and accounts for all necessary investments or other actions to ensure the realization of the DSMS risk management objectives, including actions by other Federal and non-Federal entities.
- Engineering (Technical) Feasibility: used to consider whether an alternative can reasonably be constructed, including any significant engineering or construction constraints. Consideration was given to things such as technical feasibility, and if a plan creates risk to the dam during or after construction.
- Environmental Effects: takes into account the surroundings or conditions in which a person, animal, plant, or any other living organism lives, operates, and resides.

The screening of the final array of alternative plans eliminated five of the initially considered alternative plans: Remove Dam, Replace Dam, Transitional Flip Stilling Basin, Remote Conventional Stilling Basin, and Concrete Overlay of Exposed Rock in Stilling Basin. A summary of the evaluation of alternatives with the screening criteria is provided in the Table 3-1, with additional detail in the paragraphs which follow the table.

Evaluation & Summary Criteria	Table 3-1. Alternatives Detailed Evaluation & Comparison Summary						
	No Action (FWAC)	**Remove Dam**	**Replace Dam**	**Downstream Conventional Basin**	**Transitional Flip Stilling Basin**	**Stilling Basin w/ Super-Cavitating Baffles**	**Concrete Overlay in Stilling Basin**
Effectiveness (Incremental Risk Reduction)	Not effective. There will be minimal risk reduction beyond DSA construction. Risks would remain above tolerable risk guidelines.	Effective at reducing incremental risk. However, would significantly increase non-breach risk and would eliminate authorized purposes of flood risk management.	Effective at reducing risk.	Effective. Expected to reduce risk below tolerable risk guidelines.	Effectiveness uncertain. Significant scour would occur downstream of flip component introducing uncertainty in performance.	Effective. Expected to reduce risk below tolerable risk guidelines.	Not effective. Would not meet tolerable risk guidelines as a standalone plan without other structural features.
Efficiency (Cost)	~$15M to install 66 dam anchors to meet risk condition estimated in 2016 ECRA.	A full cost estimate was not developed, however cursory estimates of construction cost exceed $200M. Significant environmental effects leading to high mitigation cost.	A full cost estimate was not developed, however cursory estimates of construction cost exceed $1B. This is expected to be the most expensive plan.	This plan is expected to be between $400M and $700M.	This plan is expected to be between $300M and $500M.	This plan is expected to be between $300M and $500M.	This cost was not developed as the alternative did not meet tolerable risk guidelines.
Acceptability	Not acceptable because risks would not be within the agency's tolerable risk guidelines.	Acceptable. However, it would increase non-breach risk for more frequent flood events which eliminates authorized purposes of flood risk management.	Not acceptable. Environmental impacts and potential consequences to a Resource category 1 habitat would be significant.	As there are other reasonable alternatives available which would meet objectives and avoid permanent impact to this high value habitat, this alternative is considered unacceptable in terms of applicable laws, regulations and public policies.	As there are other reasonable alternatives available which would meet objectives and avoid permanent impact to this high value habitat, this alternative is considered unacceptable in terms of applicable laws, regulations and public policies.	Acceptable; Least Environmentally Damaging Practicable Alternative.	Not acceptable because risks would not be within the agency's tolerable risk guidelines.
Completeness	Not Complete	Complete	Complete	Complete	Complete	Complete	Not Complete
Engineering (Technically Feasible)	It is constructible. A work platform will have to be installed across the primary spillway.	It is constructible. However, release of accumulated sediment may create complexities in implementation.	There are constructability issues and complexities associated with siting and constructing new dam.	It is constructible. However, there are challenges with constructing the cofferdam due to the height requirement caused by the deep excavation.	It is constructible, but additional measures may be required to address scour concerns such as a large cutoff wall or a pre-formed scour hole. There are uncertainties and constructability challenges if these measures are required.	It is constructible. It has fewer constructability concerns compared to other alternatives with the exception of no action and the concrete overlay.	It is constructible. However it does not technically address all the component of the failure mode leaving the risk above tolerable guidelines.
Environmental Impacts	Minimal from installation of dam anchors. However, if breach were to occur, impacts would	Short term adverse effects associated with demolition, spoil, release of sediment. Long-term	Significant permanent impacts due to construction likely within a	Significant permanent impacts due to construction in a Resource category 1	Significant permanent impacts due to construction in a Resource category 1 habitat only if measures (cutoff wall or pre-formed scour	Minimal environmental impact. Permanent features are within the existing dam footprint.	Potential temporary impacts from unwatering the primary basin for installation. However, if

	be significant and permanent	beneficial effects associated with return to free flowing stream.	Resource category 1 habitat.	habitat.	hole) are required to address scour.	Temporary impact of Resource Category 1 habitat.	breach were to occur, impacts would be significant and permanent.
Conclusion of Screening process	**Retained** for comparison purposes and as required by NEPA. Does not meet objectives (tolerable risk guidelines) NED (comparison purposes).	**Eliminated** Elimination of flood risk management purpose and increase in non-breach risks.	**Eliminated** Inefficient compared to other plans. Effects to Resource Category 1 habitat would be significant and permanent.	**Eliminated**. Inefficient compared to other plans and effects to Resource Category 1 habitat would be significant and permanent.	**Eliminated**. Technically challenging with uncertain effectiveness and effect to Resource Category 1 habitat could be significant and permanent.	**Selected**. Only RMP that meets goal and objectives of DSMS effectively, efficiently and without causing significant permanent environmental impacts.	**Eliminated**. Does not meet goals and objectives of the DSMS.

- Removal of the Dam:
  This alternative plan would include removal of all or a portion of the Bluestone Dam to eliminate impoundment. Flows would return to pre-dam conditions eliminating the Dam's ability to meet its originally authorized purpose. Flood risk management benefits, which are estimated at greater than $87M annually, would no longer be realized. It is expected sediment, which has deposited within the reservoir area since dam construction, would be released in whole or in part causing short-term significant impact to downstream Resource category 1 habitat. However, long-term beneficial effects would be realized by returning the stream to free flowing conditions. Measures to minimize adverse effects would need to be integrated in removal plans. Dam removal was considered unacceptable as it would eliminate flood risk management benefits, recreation and other benefits associated with the Bluestone Dam. Floodplain development has adjusted to the dam being in place; therefore, removal of dam would result in more damages more frequently. As other more reasonable alternatives exist to meeting the study objectives, further consideration of removal of dam alternative is eliminated.

- Replacement of the Dam:
  This alternative consists of removing and replacing the existing dam. It is likely this alternative would include designing a new dam to meet all USACE guidelines; but it could be optimized to construct a dam that would only meet tolerable risk guidelines. It is expected that the replacement dam would be a concrete structure with an overflow section as a spillway. The replacement would be expected to address all failure modes and meet tolerable risk guidelines. This plan would also include any mitigation required for impacts to the environment.

  The plan is clearly inefficient when compared to other alternatives which achieve risk management objectives (tolerable risk guidelines). A full cost estimate was not developed but a cursory analysis indicated cost may well exceed $1B. There are also concerns regarding complexity and technical feasibility of removing the existing dam and finding a site location as efficient as the existing one to capture flood waters. Moreover, there would be permanent adverse effect to Resource Category 1 habitat, or other sensitive habitat associated with the construction of a new dam and removal of the existing dam. As other more reasonable alternatives exist to meeting the study objectives, further consideration of replacement of the dam is eliminated.

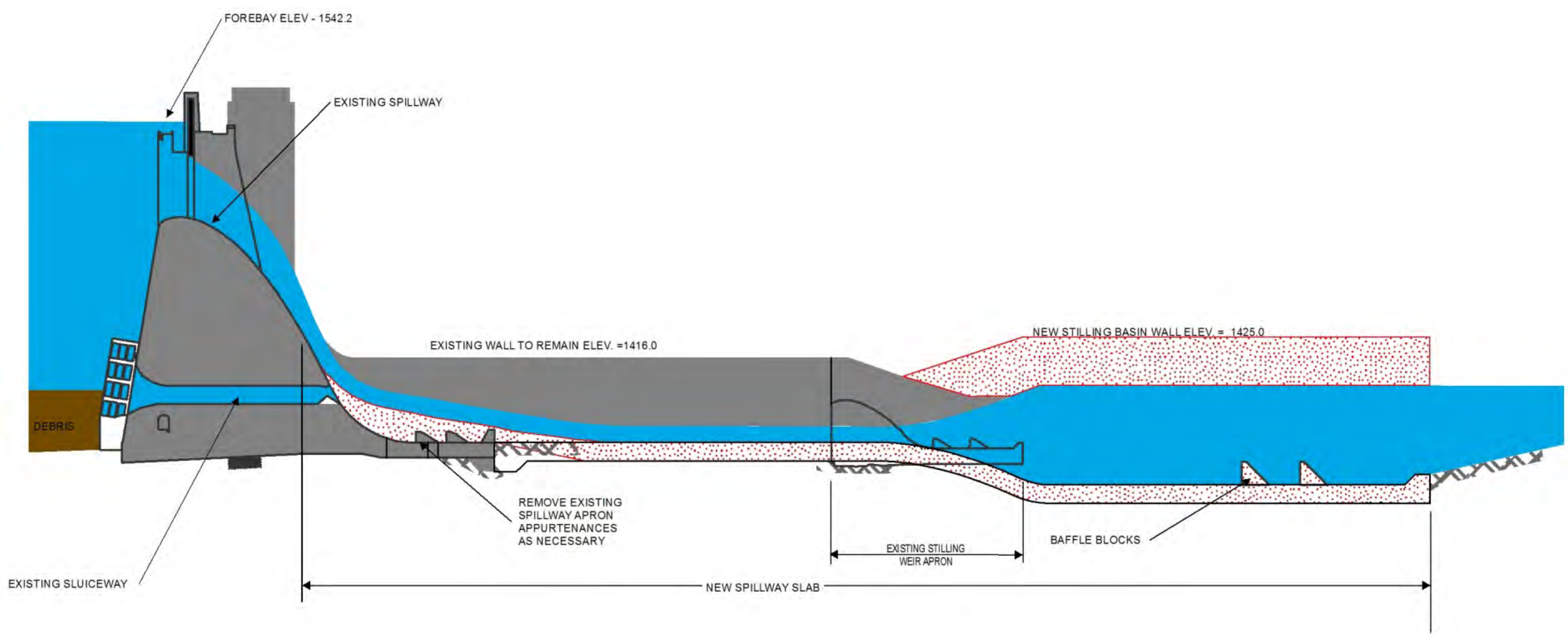
- Concrete Overlay:
  This alternative consists of a protective concrete apron overlay for the approximately 180 feet of natural riverbed in the first stage between the dam and the existing stilling weir. To further stabilize against pressure in the foundation created by seepage from reservoir pool, this alternative would include anchors in both the existing apron and concrete slabs. Though this alternative would provide some minimal risk reduction, it is not expected to be sufficient to meet

tolerable risk guidelines as it does not address all the components of the failure mode associated with instability of the weir or second stage apron. Moreover this alternative does not improve the hydraulics of the stilling basin. Concrete overlay was eliminated from further consideration as it did not meet the goals and objectives of the DSMS.

- Downstream Conventional Basin**:**
  This alternative plan would include the construction of a second stilling basin with baffles downstream of the existing stilling basin (Figure 3-2). This additional stilling basin would extend approximately 300 feet downstream of the end sill of the existing stilling weir to the downstream end of the new basin. The existing weir and baffle blocks would be removed and replaced with a transition zone between the existing stilling basin at elevation 1,368 and the new, deeper stilling basin of elevation 1,345. The entire length of the channel bed within the two stilling basins and transition zone would be covered with a concrete apron slab, and baffle blocks would be installed near the end of the second basin. A new stilling basin wall along the right and left bank of the new stilling basin would be constructed to elevation 1,425.

  The plan is inefficient when compared to other alternatives which achieve risk management objectives (tolerable risk guidelines). There are also concerns regarding complexity of extending the stilling basin downstream. The footprint of this alternative would impact more of the downstream environmental resources than the other alternatives, primarily an additional 300 feet of Resource Category 1 habitat, considered high quality by USFWS and further described in Section 4.3.2, in the New River downstream of the dam. As other more reasonable alternatives exist to meeting the study objectives, further consideration of downstream conventional basin is eliminated.

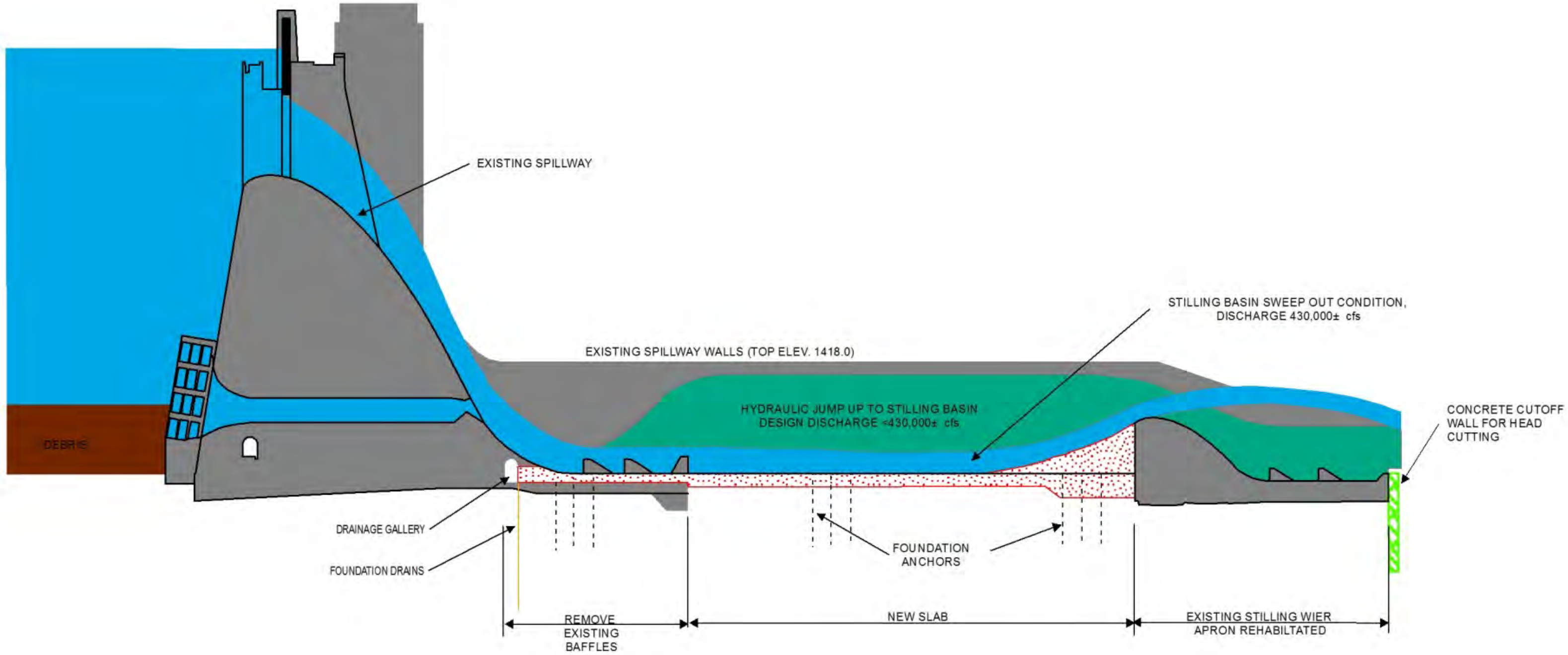
- Transitional Flip Basin**:**
  This alternative plan would include the construction of a new concrete apron slab within the existing stilling basin with foundation anchors that would transition to a flip bucket spillway just upstream of the existing weir (Figure 3-3). By sloping the new concrete apron slab upward toward the crest of the existing weir, a hydraulic jump would be created which would dissipate some of the water's kinetic energy. Often a flip basin spillway would be constructed with an adjacent downstream plunge pool of adequate depth to allow the water to fall into downstream waters without creating a large scour hole. If plunge pool construction were included in this alternative plan, such a pool would impact additional Resource Category 1 habitat. If this alternative does not include an adjacent plunge pool, the alternative would include the construction of a steel sheet pile cutoff wall downstream of the existing stilling weir apron to prevent possible scour caused by the falling water from migrating upstream and compromising the stability of the dam.



DOWNSTREAM CONVENTIONAL BASIN ALTERNATIVE PLAN CONCEPT

Bluestone Dam SEIS

Figure: 3-2
Date: June 2016
Scale: Not to Scale
Source: GEC
Map ID: 0027970110000-3178



TRANSITIONAL FLIP BASIN ALTERNATIVE PLAN CONCEPT

Bluestone Dam SEIS

ECS - GEC JV

Figure: 3-3
Date: June 2016
Scale: Not to Scale
Source: GEC
Map ID:0027970110000-3178

Significant concerns about the effectiveness and technical feasibility of transitional flip basin were identified, especially when compared to other alternatives which achieve risk management objectives (tolerable risk guidelines). Secondarily, there would be permanent adverse effect to Resource Category 1 habitat, or other sensitive habitat associated with the construction of this stilling basin that are avoided by other more reasonable alternatives. As other more reasonable alternatives exist to meeting the study objectives, further consideration of transitional flip basin is eliminated.

This alternative plan was eliminated from the final array of alternative plans because it did not meet two of the screening criteria: Environmental Impacts and Robustness. There is significant uncertainty in the impact that a potential scour hole could have on the stability of the dam, undermining the robustness of this alternative. Whether a plunge pool is constructed or the downstream area is allowed to naturally scour over time, there would be greater impacts to additional Resource Category1 habitat in New River downstream of the dam. Therefore, this alternative does not meet the Environmental Impacts criteria.

3.3 Discussion of Currently Considered Alternatives

The following two alternatives remained after screening, and were carried forward for further analysis.

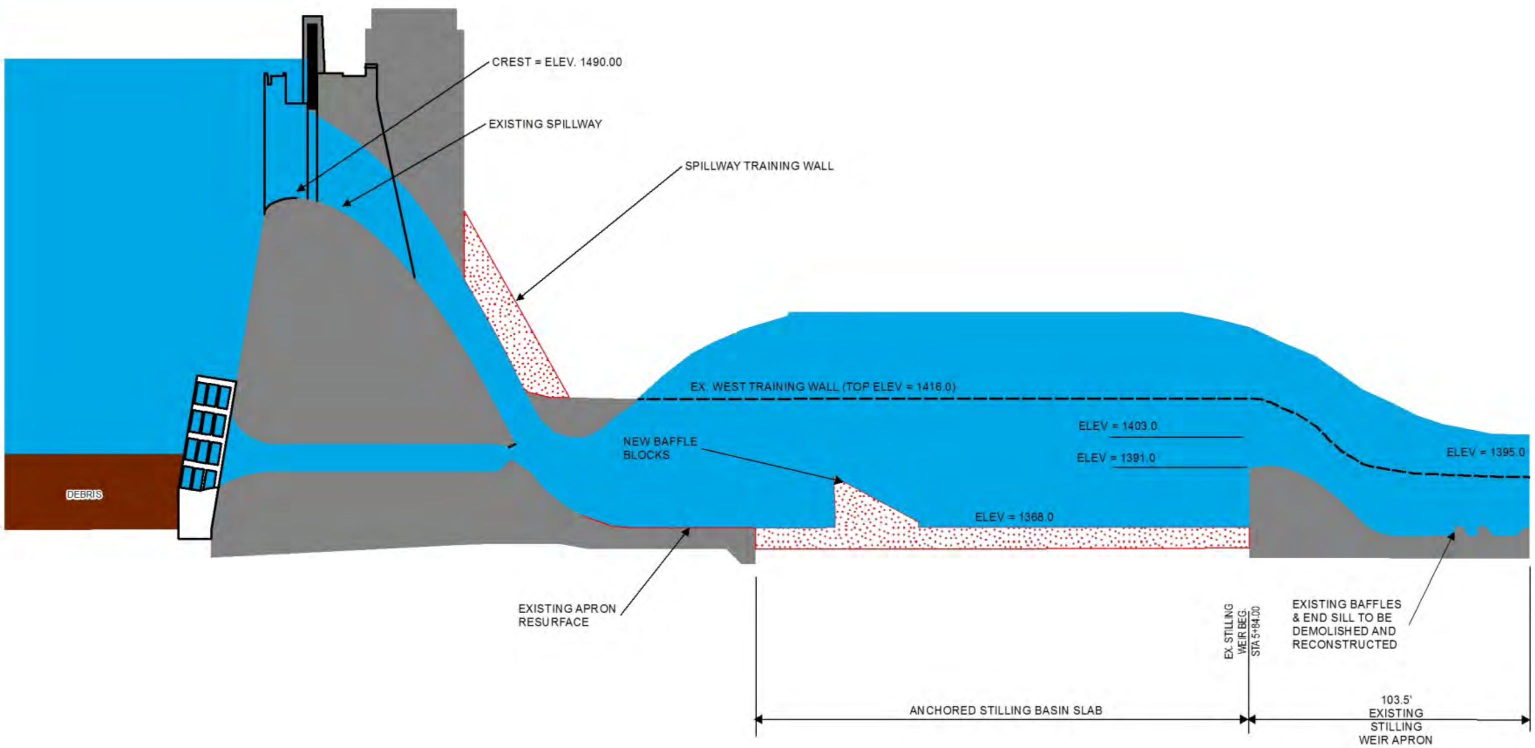
It should be noted that, in addition to the following two alternatives, the impact analysis in this SDEIS will also consider the impacts associated with the extended construction duration of Phases 1, 2A, 2B, 3, and 4. In the 1998 DSAS FEIS, all work was expected to be complete by 2005. Although Phase 1 was completed in 2004, due to funding constraints, Phase 2A was completed in 2007, Phase 2B was completed in 2011, and Phases 3 and 4 are ongoing, and are expected to be completed in 2026 with the majority of the major construction completed in 2019. A detailed description of the work included in each of these phases was provided in Section 2.2.3.

3.4 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

3.4.1 Summary of Alternative 1

The TSP involves various features and risk management measures formulated to ensure stability of the stilling basin and the dam during extreme flood events. Under the TSP, the modified stilling basin would remain a two stage system within the same footprint with the following modifications and features (Figure 3-4):

- A protective concrete apron overlay for the approximately 180 feet of natural riverbed in the first stage between the dam and the existing stilling weir



HYDRAULIC JUMP BASIN WITH SUPERCAVITATING BAFFLES PLAN CONCEPT (TSP)

Bluestone Dam SEIS

ECS - GEC JV

Figure: 3-4
Date: June 2016
Scale: Not to Scale
Source: GEC
Map ID: 0027970110000-3178

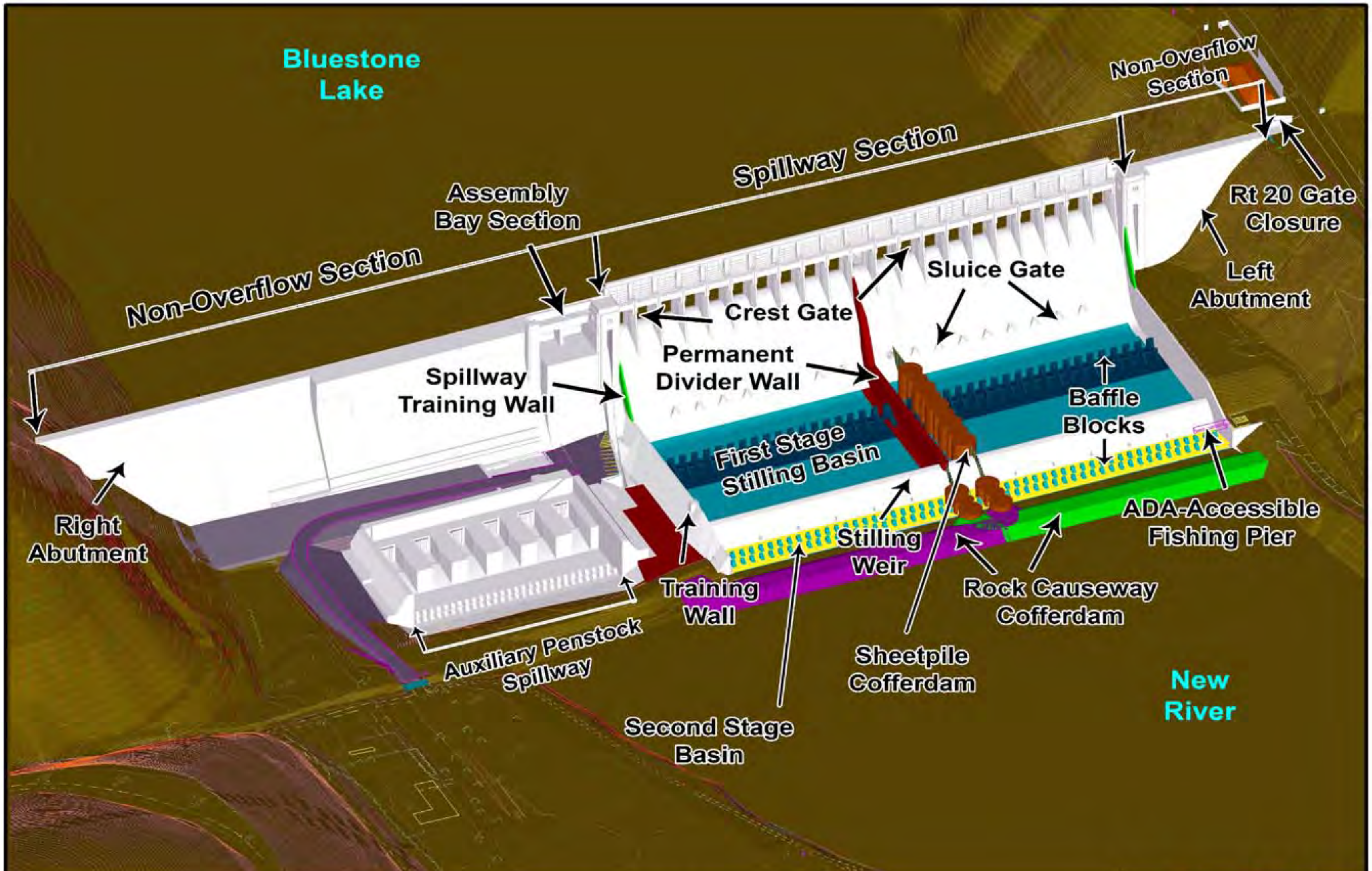
- Demolition of the existing first stage baffle blocks, endsill and a portion of the existing apron slab and construction of new, larger, anchored blocks and resurfacing of the existing apron.
- Anchors in both the existing and new concrete slabs to stabilize against uplift pressures in the foundation created by underseepage from the reservoir
- Construction of new drainage features within the dam or first stage basin to relieve some of the uplift pressures
- Installation of stabilization anchors in the stilling weir and stilling basin training walls
- Installation of ten-foot high extensions of the existing spillway right and left training walls
- Addition of scour protection behind both stilling basin training walls
- Demolition/reconstruction and anchoring of the second stage concrete endsill and baffle blocks within their existing footprint to ensure stability and satisfactory performance
- Installation of means to remotely operate crest gates in order to reduce the life safety risk of dam operators during a flood event.
- Construction of a permanent divider wall to bisect stilling basin

Figure 3-5 shows a 3-D model of the proposed dam modifications. Additionally, the TSP would include the non-structural risk management measures that would be also taken under the No Action Alternative. These measures include an enhanced risk communication plan to regularly educate the downstream communities and public of the potential flood risk, emergency procedures and shared responsibility intended to reduce the overall risk of life and property. It would also include necessary maintenance of dam features and operating machinery, as described under the No Action Alternative.

3.4.2 Construction Activities

- <u>Duration, Access, and Construction Work Limits</u>
  Construction activities for the proposed action are estimated to last between eight and ten years. The construction of the proposed action features would likely commence after, but not immediately after, the completion of Phase 3 and 4 of the 1998 DSA Project. As discussed in Section 1, it is anticipated that Phase 3 construction will be complete in 2017, and Phase 4 construction will be complete in 2026, with the majority of the major construction completed in 2019.

  Construction access to the site would be provided via several routes: 1) the existing access road on the left descending bank of the river (via State Route 20 and down the existing road), which is currently used to access the tailwater public fishing pier adjacent to the dam; 2) Miller Avenue in Bellepoint, on which material and equipment hauling would be restricted to Monday through Friday, 9:00 a.m. to 2:00 p.m.; 3) the existing access road to the bulkhead located on the left bank upstream of the dam; and 4)



3-D MODEL OF PROPOSED DAM MODIFICATIONS

Bluestone Dam SEIS

ECS - GEC JV

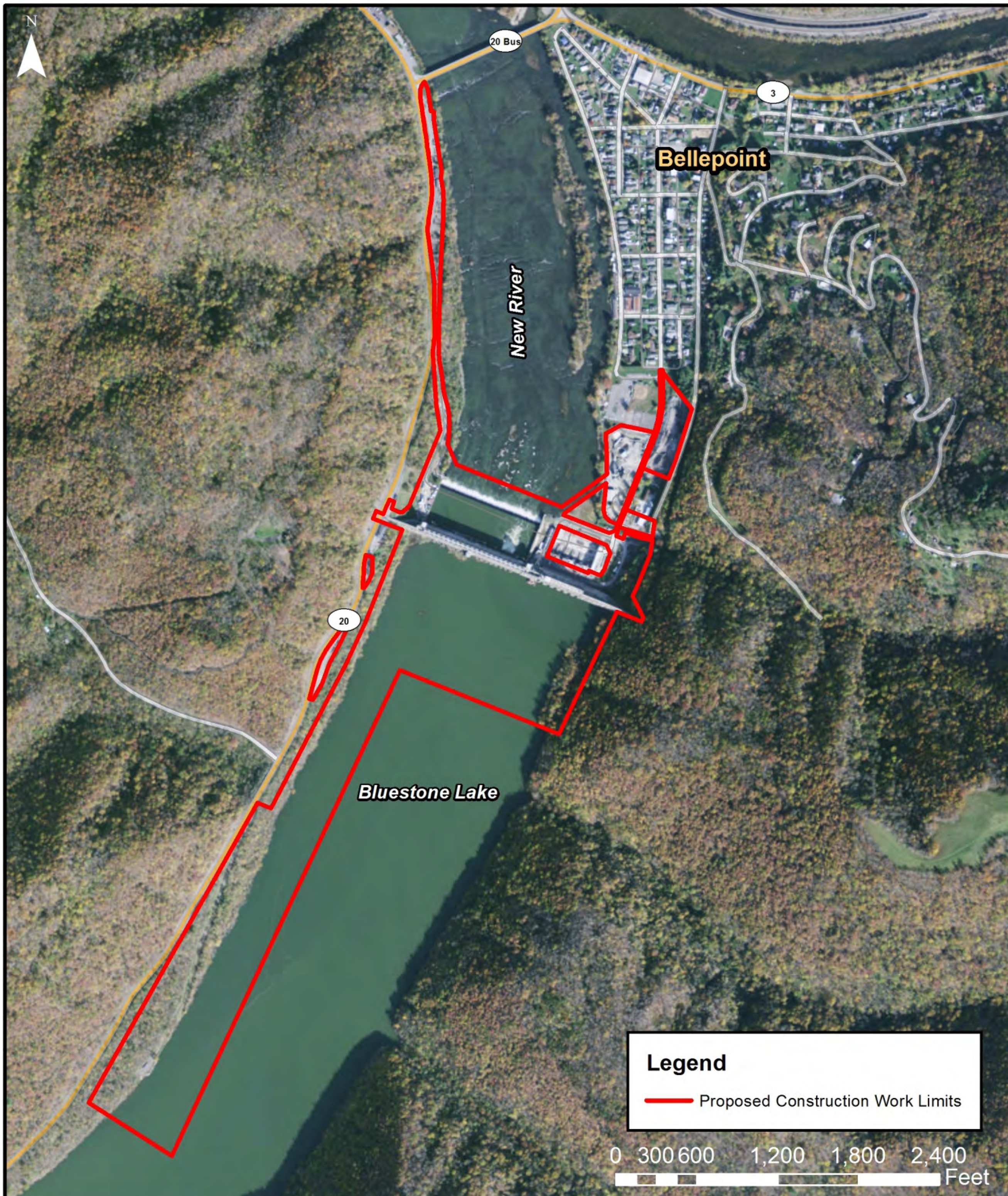
Figure: 3-5
Date: August 2016
Scale: Not to Scale
Source: GEC
Map ID: 0027970110000-3178

the existing access road on the left bank upstream of the dam to the existing bulkheads on the lake for boat access. These access roads, with the exception of Miller Avenue, would be closed to the public once construction commences. Slight realignment of the existing access road on the left descending bank may be required, or the possible construction of a spur road from the existing access road to a proposed cofferdam tie-in at the bank.

Open space in the areas adjacent to the project site would be required for storage of equipment and materials, possible development of a concrete batch plant, and parking for construction vehicles. These staging areas would likely mimic those currently in use by the Phase 3 and Phase 4 construction contractors although additional staging areas could be created as needed within the larger Construction Work Limits (CWL) shown in Figure 3-6. Staging areas within Hinton City Park and publicly accessible areas within USACE property would be restored to their pre-construction condition after construction of the proposed action is complete. No tree clearing upstream of the dam is expected for staging or temporary access, but tree removal may be necessary on the downstream side of the dam for staging, access, temporary construction features described below and/or permanent features.

While the hauling of material and equipment on Miller Avenue would be limited to Monday through Friday from 9:00 a.m. to 2:00 p.m., all other construction work within the project footprint could include nighttime work.

- Stilling Basin Divider Wall
  Installation of concrete within the stilling basin requires a dry condition; however, flow must be maintained through the dam to allow continued operation of the flood control facility. Thus, construction is anticipated to be constructed in two stages. A temporary cofferdam wall would be built perpendicular to the face of the dam, which in combination with the stilling weir, would allow for temporary dewatering of the primary, or first stage, stilling basin from the dam face to the stilling weir. A permanent divider wall (see Figure 3-5) would then be constructed within the dry portion of the stilling basin to approximately elevation 1401 to bisect the existing primary stilling basin into two halves, only one of which would be closed to flow at a time. This staged construction would allow for continued use of eight of the sixteen sluice gates to maintain flow during construction. The divider wall would remain a permanent fixture of the facility, serving two purposes after construction is complete: 1) further relieving the uplift pressure on the stilling basin due to its dead weight and 2) allowing for future dewatering of half of the stilling basin to allow longer duration inspection of the facility.



PROPOSED CONSTRUCTION WORK LIMITS FOR TSP

Bluestone Dam SEIS

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Figure: 3-6
Date: May 2016
Scale: 1:12,000
Source: ESRI/GEC
Map ID: 0027970110000-3178

Several alternative means to provide for dewatering of the stilling basin were considered before determining that use of a divider wall and half of the sluice gates was the most feasible and effective solution. These other alternative means included:

- Maintaining flow through two-thirds of the sluice gates while dewatering one-third of the stilling basin at a time.
- Installation of controlled penstock conduits, through the installation of gates which can be operated, to allow use of the existing four penstocks for full diversion of normal and minor flood flows, while dewatering entire stilling basin
- Installation of controlled penstock conduits in two penstocks, maintaining flow through half of the stilling basin plus two penstocks while dewatering the other half of the stilling basin.
- Maintaining flow through half of the stilling basin and two uncontrolled penstocks (gates remain open) while dewatering the other half of the stilling basin.

The cost, environmental and recreational impacts, operational impacts and impacts to the implementation of the dam safety modifications were all considered in weighing these alternative means of dewatering. While dewatering of half of the basin without use of the penstocks would increase the frequency and duration of conditions which exceed normal pool conditions upstream of the dam, this option is less costly than the alternatives requiring controlled penstocks, or the alternative requiring multiple stages of a cofferdam. Use of uncontrolled penstocks, which would be less costly than installation of penstock controls, would increase flood risk downstream of the dam, as there would be less flow control during construction. And while use of penstocks alone would create efficiencies for construction activities within the stilling basin, the flow of water out of the penstocks would present potential erosion to right bank during higher flows resulting in greater impacts to the right descending bank of the river and its aquatic resources than the alternatives that do not use penstocks. Based on this analysis, the dewatering of half of the basin while maintaining flow through the other half without use of the penstocks is carried through for analysis as part of the TSP.

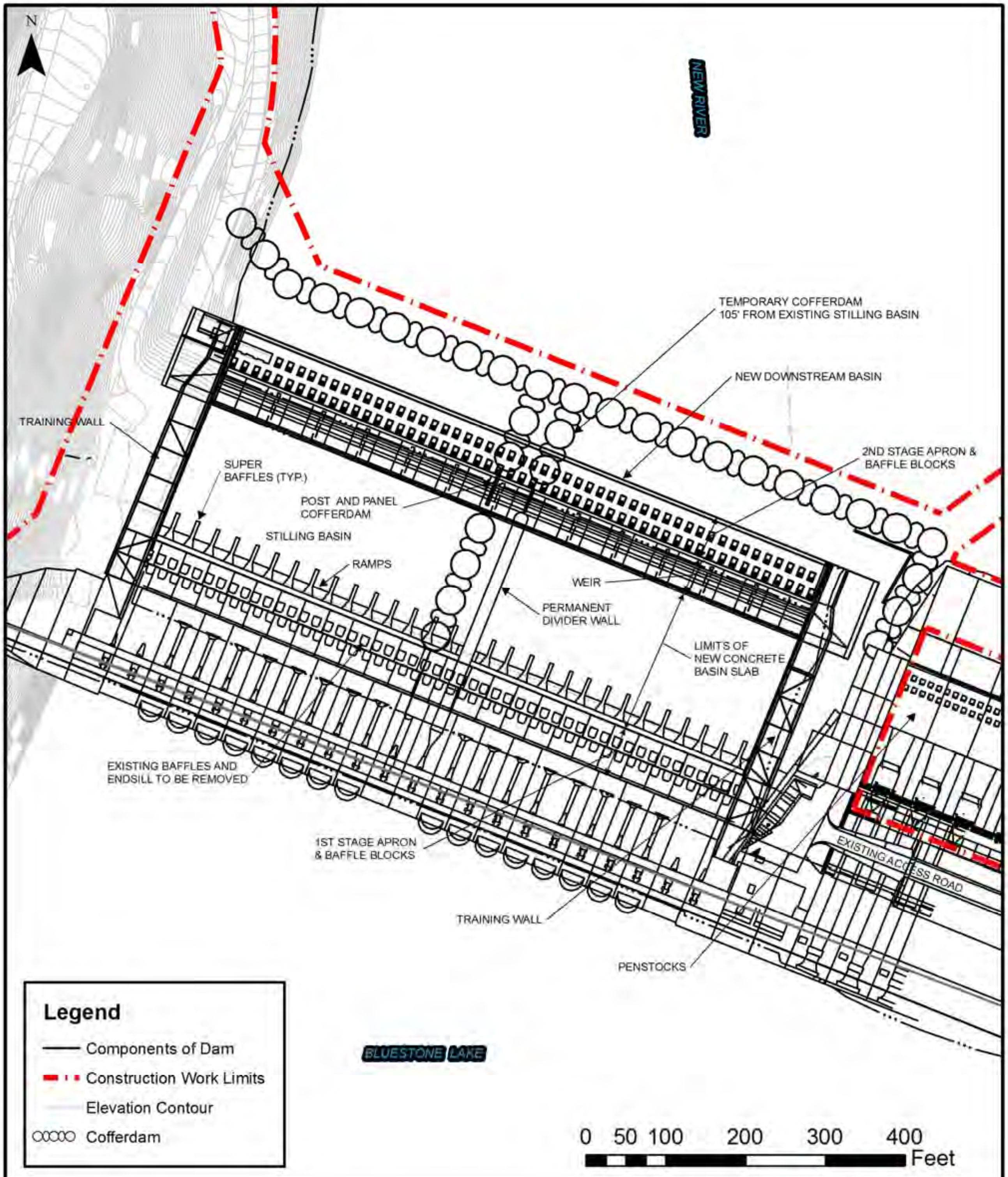
- <u>Stilling Basin Cofferdam</u>

  In order to dewater the first and second stage stilling basin, a temporary cofferdam would be built across the downstream end of the second stage stilling basin. Several possible configurations for this cofferdam are under consideration. Regardless of the type of cofferdam used, this work would be accomplished in two stages, with half of the cofferdam being built and utilized for dewatering at one time. The right side (facing downstream) of the cofferdam would be built first, tying into the right penstock training wall, cross the channel downstream of the second stage baffle blocks, and tie into the cofferdam wall running perpendicular to the dam face. Once construction of the TSP is complete on the right side of the stilling basin, the right half of the cofferdam would be removed and the left side cofferdam would be built and utilized to dewater the left side of the stilling basin for construction of the TSP, tying into the left descending bank and the new divider wall.

One possible cofferdam design includes a series of steel sheetpile coffer-cells (Figure 3-7). In this configuration, the sheetpile face of the coffer-cells would not be driven below the ground surface; instead, the bottom of the pile cells would be placed on the surface of the riverbottom and filled with rock, the weight of which would aid against the sheetpile from moving up or downstream. To ensure that water is not able to seep under the sheetpiles, grout bags or a shallow layer of tremie concrete would be placed along the seam where the sheetpile meets the riverbed to seal any existing gaps. Between the end sill of the existing stilling basin and the interior portion of the cofferdam cells, a rock causeway would likely be placed first in advance of the cofferdam cells to facilitate construction of the cofferdam cells. The rock causeway would be within the footprint of the construction work limits on the upstream side of the cofferdam cells.

A second possible configuration of the cofferdam would be a rock causeway (Figure 3-8). Once one half of the first stage stilling basin is dewatered and flow is restricted, stone would be pushed out into the riverbed, starting from the dry land of either the right descending bank or existing Phase 3 penstock cofferdam. Equipment would travel along the top of the causeway to continue the construction of the causeway until it connects to the cofferdam wall running perpendicular to the dam face. The downstream face of the rock causeway would be made watertight through the use of material such as a geomembrane, rip rap, or polypropylene bags filled with sand or rock. This reinforcement would also prevent erosion of the causeway, so that the material does not move downstream. The rock for the causeway would likely be durable orthoquartzite from excavation of the bedrock from the spillway floor and/or durable limestone from a commercial source.

- <u>Drainage Gallery</u>
  A new drainage gallery would be mined through the concrete of the existing dam and tied to the existing drainage gallery. New foundation drains would be drilled from this gallery into the foundation under the dam. All of this work is confined to the interior of the existing dam. Concrete excavated for this work, estimated to be less than 3,000 cubic yards of material, would also be handled as described in the disposal methods outlined below.

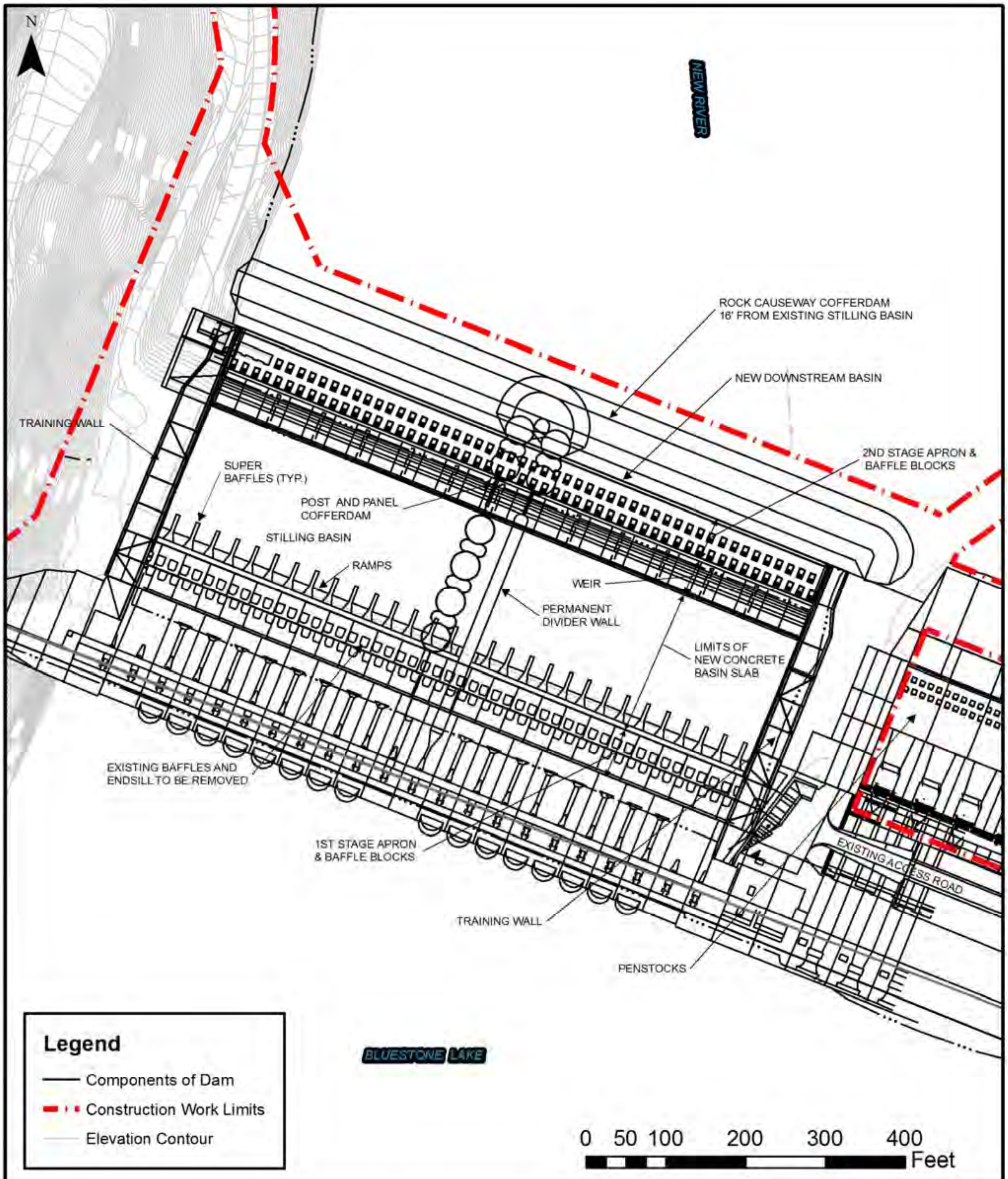


Plan View of Cofferdam in Relation to the Dam

Bluestone Dam SEIS

ECS - GEC JV

Figure: 3-7
Date: June 2016
Scale: 1:2,000
Source: ESRI/GEC
Map ID: 0027970110000-3178



Plan View of Rock Causeway Cofferdam in Relation to the Dam

Bluestone Dam SEIS

ECS - GEC JV

Figure: 3-8
Date: June 2016
Scale:1:2,000
Source: ESRI/GEC
Map ID: 0027970110000-3178

- <u>Training Wall</u>
  Up to an additional ten feet of reinforced concrete would be added to the top of the existing spillway training walls which run perpendicular to the face of the dam to the stilling basin training walls on the left and right descending side of the dam. Scour protection in the form of concrete would be added behind both stilling basin training walls to guard against erosion in the event of water overtopping these walls. On the right training wall, the concrete would be placed to cover existing rock. On the left training wall, existing fill material would be removed to reach existing rock layer at the base of the wall, a protective layer of concrete added, then fill material would be replaced to the existing height. Consideration may be given to the type of fill material to be used after concrete placement, or placement of concrete over the existing fill material. Regardless of the final design, anchors would be added to both the existing stilling basin training wall and new scour protection.

- <u>Tailwater Fishing Access</u>
  The existing ADA-accessible fishing pier on the left descending bank below the dam would be removed to provide adequate space and access to the stilling basin area during construction. This pier would likely be removed prior to initiation of construction.

- <u>Concrete Conveyance and Installation</u>
  Possible methods for conveyance of concrete necessary to construct the various features of the TSP are currently under development. The construction site would likely include a concrete batch plant on site, built in the location of the current plant on the right descending bank of the river, to minimize the hauling of concrete via truck down Miller Avenue in Bellepoint from an offsite concrete batch plant. In order to transport concrete from an onsite batch plant to locations within the project site, one or several options may be used. An access road currently exists between the right descending bank of the river and the right training wall, on an earthen berm just downstream of the penstock area. Although this berm was scheduled for removal after completion of current construction on the penstocks, the removal could be delayed to allow for use of the access road for some portion of construction of the TSP. Use of this access road would allow for hauling to the right half of the stilling basin. Another method is construction of a braced mechanical conveyance system, which would run diagonally from the batch plant on the right descending bank to the left half of the stilling basin. This braced system could include supports placed within the tailwater area. Consideration is also being given to construction of a batch plant on the left side of the stilling basin within the construction work limits.

  New concrete would be installed within the first stage stilling basin as overlay protection, resurfacing of the existing apron, new baffle blocks, a divider wall and additional spillway training wall height. New concrete would be installed within the second stage stilling basin as a new endsill and baffle blocks. New concrete would also be placed behind the existing stilling basin training walls. All new concrete, with the exception of the divider wall and spillway training wall, would be anchored with either bars or multi-strand high strength anchors. Anchors would also be added to the existing first stage stilling basin apron and weir, and the second stage stilling basin apron.

- Waste Material Removal and Disposal
  In order to establish a stable foundation on which to construct the new concrete slab apron within the stilling basin, existing rock within the stilling basin would be removed using line drilling and an excavator and/or hoe-ramming. Any existing concrete to be demolished or removed from the existing structure would be removed using diamond saw cutting and/or hoe ramming. Excavated material would be stockpiled on site prior to appropriate disposal. No blasting would be utilized for demolition of any features of the existing dam or foundation. To minimize the discharge of any sand during concrete cutting during concrete removal and anchor placement, cuts would be flushed with water and pumped to a lined settling basin on one of the downstream banks of the river, most likely the left side where an existing settling basin exists for Phase 3 and 4 construction.

  It is estimated that approximately 150,000 - 250,000 cubic yards of material would be removed from the site during and after construction, which includes materials demolished from the existing structure as well as temporary material used during construction, such as the coffer-cells. Rock crushing equipment may be used to process excavated material. Excavated sandstone may be used as replacement backfill material for existing backfill in areas that are temporarily excavated. Any waste material removed from the site would be disposed of in accordance with all applicable laws, regulations and policies. Unregulated material may be re-used or sold by the construction contractor. Those materials not re-used or sold by the contractor that do not require disposal in a permitted landfill could be disposed of in a permitted landfill or other approved off-site disposal sites within 40 miles of the dam. If during detailed engineering and design, off-site disposal sites are proposed for use, additional supplemental NEPA documentation and permitting would be required.

- Real Estate Acquisition
  Additional land required for the project is approximately 3 acres of temporary work area easement. This land is needed for contractor laydown and staging. It is estimated that the temporary work area easement is required for 10 years in order to facilitate the ongoing construction at the dam. Other real estate will need to be acquired for a

spoil/disposal area to be used during construction but it has yet to be determined where that area will be located. Real estate may also have to be acquired for mitigation purposes. Once lands required for spoil and mitigation have been identified, a subsequent supplement to the Real Estate Design Memorandum will be prepared and forwarded for approval

3.4.3 Operation Activities

- Water Control During Construction

  The maximum flows (or stages) that can be maintained at points along a channel below a dam are called control flows (or stages). The operation of Bluestone Dam is guided by established water level control stages downstream of the dam. When downstream water levels are forecasted to exceed established thresholds, more water is retained in Bluestone Lake. The control stage below Bluestone Lake is 10.7 feet (89,400 cfs) on the U.S. Geological Survey (USGS) gage at Hinton, WV. The control stage at Kanawha Falls is 22.0 feet (146,000 cfs), and the control stage at Charleston, WV is 36.0 feet (~150,000 cfs, depending on the stage of the Ohio River). The control stages would remain effective during construction of the TSP.

  Normally, outflow from the dam is regulated to maintain a “summer pool” of elevation of 1,410 feet for recreation and fish and wildlife conservation beginning in April. In the fall, the pool is drawn down to the “winter pool” at an elevation of 1,406 feet to allow for additional flood control storage. In order to sustain downstream aquatic populations, a minimum discharge of 610 cfs is always maintained. Given that half of the stilling basin gates (8 of the 16) would be closed to flow at any one time during construction of the TSP, the sluice gate operational scenario during construction would differ from existing operations. However, the target water elevations (summer and winter pools) would still be maintained under non-flood conditions and the necessary flow to obtain these elevations and the minimum discharge would be achieved through the use of up to eight sluice gates at a time.

  In order to meet required downstream flow conditions and water level control stages during construction, out of pool conditions could occur upstream of the dam for approximately three times as many days as currently experienced upstream of the dam. The lake pool levels could also occur for longer durations, and could occur at higher elevations more frequently. Out of pool refers to higher than normal pool water elevation upstream of the dam. A comparison of the annual probability of exceedance of various elevations between the current operation and water control during construction is provided in Table 3-2. As this table demonstrates, exceedance of higher elevations is more likely during construction of the TSP. Additionally, out of pool conditions are currently experienced an average of 18 days per year, which could increase to approximately 54 days per year during construction of the TSP.

Table 3-2. Annual Probability of Elevation Exceedance for Current Operations and TSP

Probability of Exceedance	Current Operations	TSP Construction	Probability of Exceedance	Current Operations	TSP Construction
0.02	1498.1	1509.8	0.51	1433.8	1445.4
0.03	1497.5	1505.9	0.52	1433.3	1445.1
0.05	1488.0	1501.5	0.54	1431.6	1445.0
0.07	1482.0	1498.8	0.56	1430.8	1444.6
0.08	1467.5	1498.7	0.57	1430.6	1444.4
0.10	1466.5	1485.6	0.59	1430.4	1444.3
0.11	1463.1	1484.8	0.61	1430.0	1443.5
0.13	1460.3	1483.8	0.62	1428.1	1442.7
0.15	1459.9	1480.4	0.64	1428.0	1441.6
0.16	1459.0	1478.1	0.66	1427.5	1440.5
0.18	1457.8	1474.9	0.67	1426.4	1440.2
0.20	1457.6	1472.0	0.69	1425.4	1439.8
0.21	1456.9	1468.9	0.70	1424.7	1439.5
0.23	1454.0	1468.0	0.72	1424.3	1438.7
0.25	1453.8	1465.8	0.74	1424.0	1438.6
0.26	1451.4	1461.5	0.75	1423.8	1437.6
0.28	1448.1	1461.5	0.77	1423.4	1435.8
0.30	1447.7	1460.0	0.79	1422.4	1435.3
0.31	1447.4	1459.8	0.80	1420.0	1435.2
0.33	1447.2	1458.9	0.82	1419.5	1432.8
0.34	1446.5	1457.3	0.84	1418.5	1430.8
0.36	1444.1	1457.0	0.85	1418.3	1430.6
0.38	1442.2	1456.9	0.87	1416.7	1428.4
0.39	1441.5	1456.2	0.89	1415.7	1427.3
0.41	1440.2	1453.8	0.90	1415.1	1427.3
0.43	1438.1	1452.6	0.92	1411.9	1420.3
0.44	1437.5	1451.5	0.93	1410.4	1419.0
0.46	1437.4	1449.5	0.95	1410.0	1417.8
0.48	1437.2	1447.5	0.97	1410.0	1413.5
0.49	1434.4	1447.5	0.98	1411.3	1412.2

In order to characterize this difference in out of pool duration, frequency, and elevation, a model was run which used observed pool elevation data for 1999 through 2009 to determine how the use of only eight of the sixteen sluice gates during that time would have impacted out of pool conditions. Figures 3-9 and 3-10 are examples of a comparison of historical observed and modeled winter and summer pool elevations under normal operating conditions and modeled pool elevations for those periods had the TSP been under construction. As shown in Figure 3-9, in November 2003, the winter pool reached approximately elevation 1,465, whereas it would have reached approximate elevation 1,470 and would have stayed out of pool several days longer had the TSP been under construction at that time. Similarly, as shown in Figure 3-10, the summer pool reached approximate elevation 1,423 in May 2001, but would have reached approximate elevation 1,438 and stayed out of pool for several more days had the TSP been under construction at that time.

- Debris Control During Construction
  As a result of the 1996 Bluestone Drift and Debris Evaluation Study Report and 2000 Bluestone Dam Drift and Debris Hydraulic Model Study Final Report, a debris tower was constructed and became operational in 2005 in the 35th monolith to flush debris at various pool elevations, to allow drift and debris to flow more naturally downstream than it did previously. The drift and debris tower would not be usable during the entire length of construction. Without use of the debris tower, the process to work drift through the sluices involves positioning a barge at the trash rack of the gate in which drift is to be passed. It takes a minimum of two operators per barge for two barges in addition to another qualified person to operate the sluices and a crane operator per shift. The log loader operator on the barge would begin opening the flow of drift through the trash rack and through the sluice gate openings. The barge operator and log loader operator would work together to position the barge and continue to maneuver the drift to the trash rack and move the drift into the flow of the open sluice gate opening. The second barge is utilized to push debris toward the barge that is against the gate opening.

  When the lake is at lower elevations, water levels are lower and flow is less therefore, moving drift in front of one gate to another gate is extremely difficult. Passing drift with eight sluice gates or less would result in an increase in accumulation of drift and debris upstream of the dam because the overall volume of discharge (cfs) is typically much lower when you finally reach winter pool, and increased operation and maintenance costs for operation of the dam during construction of the TSP.

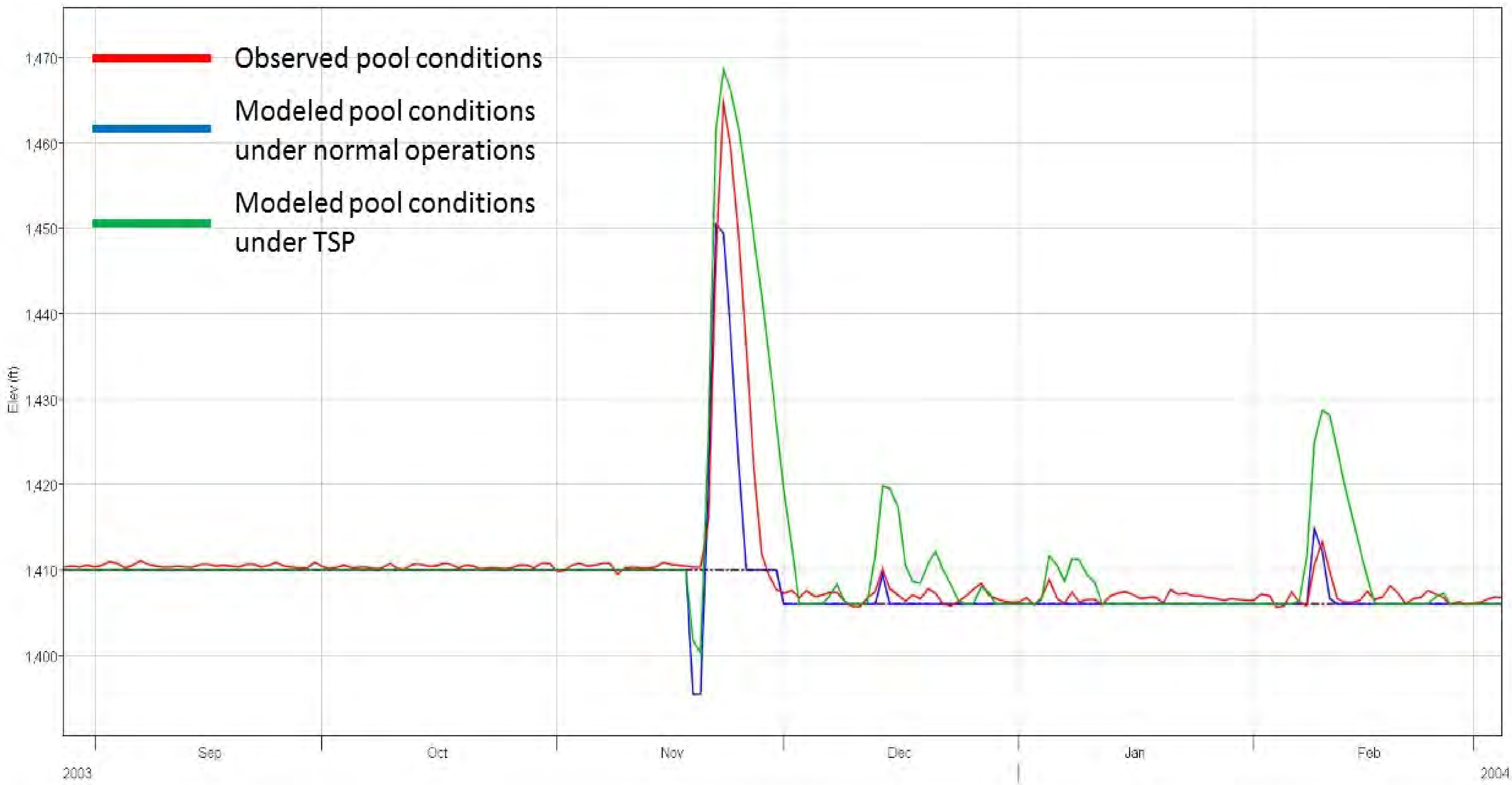


Figure 3-9. Comparison of Historical Observed and Modeled Winter Pool Elevations Under Normal Operating Conditions and Modeled Pool Elevations for those Periods.

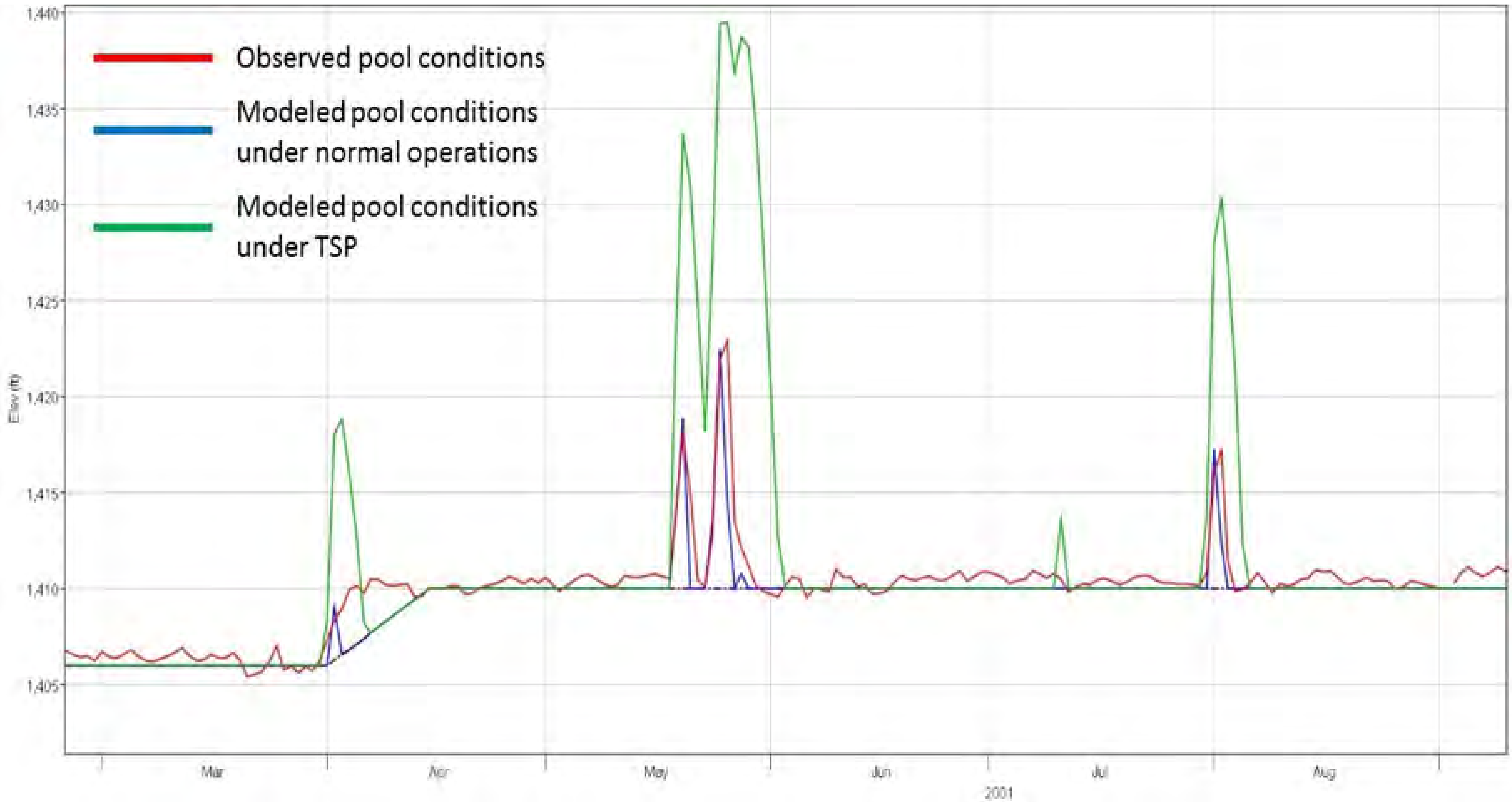


Figure 3-10. Comparison of Historical Observed and Modeled Summer Pool Elevations Under Normal Operating Conditions and Modeled Pool Elevations for those Periods.

- Post-Construction
  Once construction is complete, the dam would be operated according to the Water Control Manual (WCM), with the exception of the use of the penstocks. Use of the penstocks would require revision of the WCM.

  As described in the WCM, Bluestone Lake is part of the flood control system of the entire Ohio River Basin as well as of the New and Kanawha River Basins. Regulation procedures for the lake are correlated with the operation of the other lakes in the Kanawha River Basin and other Ohio River tributaries to the fullest extent possible while giving due consideration to local concerns and requirements.

  Operation for Ohio River control is based on retention of flows that would add to crest stages in excess of 45 feet at Point Pleasant, WV. This stage represents the stage of zero damage for the unprotected communities below the mouth of the Kanawha River.

  The maximum flows (or stages) that can be maintained at points along the channel below the dam are called control flows or regulation channel capacities. The control flow below Bluestone Lake is 90,200 cfs, or a stage of 10.7 feet on the USGS gage at Hinton, WV, which can be maintained on the New River without causing appreciable damage to the community of Hinton. Control flow at Kanawha Falls is 146,000 cfs (22.0 feet stage). At Charleston, the control flow is set at 150,000 cfs (36.0 feet stage).

3.5 Alternative 2: No Action

3.5.1 Summary of Alternative 2

The No Action Alternative assumes that the ongoing construction, which was authorized under the 1998 DSA Project, is completed. The construction authorized by the 1998 DSA Project was divided into construction phases, three of which have been completed (Phase 1, Phase 2A, and Phase 2B) as described in Sections 1 and 2. The remaining portion of the project which is currently under construction (Phase 3 and Phase 4) includes the following work:

- Phase 3:
  - Installation of a scour pad downstream of the penstock extension
  - Construction of two training walls adjacent to each side of the scour pad
  - Installation of 112 high capacity multi-strand cable steel anchors in the penstock area
  - Addition of five divider walls and two partial divider walls designed to separate flow from penstock discharge

- o Incorporation of an ogee section and baffle blocks with an end sill into the scour pad to dissipate flow energy exiting the penstocks.

- Phase 4:
  - o Installation of approximately 278 high capacity multi-strand cable steel anchors in the spillway and non-overflow monoliths.

The No Action Alternative would also include installation of means to remotely operate crest gates in order to reduce the life safety risk of dam operators during a flood event.

In addition to completion of Phase 3 and Phase 4 construction, the No Action Alternative includes completion of other work which was approved under the 1998 DSA Project, but which has not yet been awarded for construction, with the exception of the parapet wall, which would not be constructed. These activities include installation of an additional 66 monolith multi-strand cable anchors which were not originally included in the Phase 4 construction contract, as well as completion of any approved mitigation activities approved and funded which have not yet been completed. The mitigation activities originally approved and funded in the 1998 DSA Project, but not yet completed, include:

- Restoration of Hinton City Park to pre-construction condition
- A Memorandum of Agreement would be executed between USACE, the WV Division of Culture and History (WVDCH), and the Advisory Council on Historic Preservation (ACHP) to specify appropriate documentation of the Bluestone Dam prior to its alteration.

Lastly, the No Action Alternative would continue risk communication activities conducted by the USACE to ensure downstream communities understand residual risk. The No Action Alternative would also include actions conducted by the downstream communities such as continued implementation of an improved flood warning system, enhanced evacuation planning and public education regarding the risk of flooding in the affected area. These actions would be developed by downstream communities in cooperation with the USACE, local stakeholders and government bodies, as well as state and Federal emergency management agencies.

3.5.2 Construction Activities

Details regarding the construction of the Phase 3 and 4 features are provided in the 1998 DSAS FEIS. However, the construction duration for the activities described in the original EIS was underestimated because the work was ultimately constructed in phases synchronized to the allocation of funding. Construction of Phase 3 began in September 2010, and is expected to be complete in 2017. Phase 4 construction began in September 2012, and is expected to be completed in 2026 with the majority of the major construction completed in 2019. Installation of the additional 66 multi-strand cable anchors would occur within the construction window of Phase 4.

3.5.3 Operation Activities

The risk of scour, which could lead to a breach of the dam, is driven by the total discharge through the primary spillway and is exacerbated by potential failure of structures within the stilling basin, primarily the upstream apron and the stilling weir. Under the No Action Alternative, risks associated with scour in the spillway would need to be minimized through modification of the WCM to include operation of the penstocks once Phase 3 construction is complete, and an Emergency Operation Schedule to provide operational guidance in the case of loss of communication with the dam during a flood event.

Discharges through the sluice gates would need to be restricted below a threshold that balances the risk of scour with the risk of increased reservoir water heights. Under the No Action Alternative, this restriction would be accomplished by holding a partial opening of the gates to restrict discharge through the primary spillway crest gates and sluices and allowing the reservoir to exceed the design flood control pool elevation of 1,520 feet while maintaining the threshold discharge of 140,000 cfs. The penstocks would then be opened to allow additional discharge and avoid overtopping of the gates at about elevation 1,526 feet. If this combined discharge is not adequate to maintain the reservoir below the top of the gates in this partial opened position, the gates would be operated to a fully opened position to avoid overtopping of the gates.

The No Action Alternative would also include necessary maintenance of dam features and operating machinery, which could include replacement or refurbishment of some equipment, liftoff testing of the high capacity anchors, cleaning of the foundation drains, and instrumentation.

In general, liftoff testing of the anchors would be first performed five years after the anchor installation, then every 10 years after the first test. Drain reaming and pressure washing of the uplift cell piping would continue to be performed at 10-year intervals. This work was last done in 2009 and would be required again in 2019 and every 10 years thereafter. There are currently about 290 drains with a total of approximately 23,000 linear feet of drain to be reamed.

3.6 Comparative Impacts of Alternatives

Table 3-3 summarizes the impacts of each alternative on the project area’s resources. A detailed discussion of these impacts is provided in Sections 5.1 through 5.17. While some of impacts listed under the No Action Alternative arise from the prolonged duration of the 1998 DSAS feature construction, most of the impacts arise from a breach or failure of the Bluestone Dam, which is a higher risk under the No Action Alternative.

Table 3-3. Comparative Alternative Impacts

Resource	Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles	Alternative 2: No Action
Botanical Resources	• Permanent, minimal vegetation clearing • Short-term, negligible to moderate inundation impacts and resulting sedimentation	• Long-term, significant soil displacement, scouring and plant mortality • Long-term, significant exotic species advantage
Zoological Resources	• Permanent, minimal loss of terrestrial habitat • Long-term, non-permanent, moderate noise disturbance to species • Long-term, non-permanent, negligible reduction in aquatic food source abundance	• Long-term, non-permanent, moderate noise disturbance to species • Short to long-term, significant impacts to habitat availability • Permanent and significant direct mortality • Long-term, significant erosion, scour and habitat disturbance
Aquatic Resources	• Long-term, non-permanent, significant reduction in riffle-run habitat • Long-term, non-permanent, minimal sedimentation downstream of dam • Long-term, insignificant increased sedimentation upstream of dam • Long-term, non-permanent, moderate reduction in tailwater fish abundance • Long-term, non-permanent, significant flow modification impacts	• Long-term, non-permanent, moderate flow disruption • Long-term, significant habitat destruction and species mortality • Long-term, significant reduction in species abundance and diversity
Wetland Resources	• Long-term, non-permanent, minimal sedimentation downstream • Short-term, negligible to significant inundation of plants • Long-term, insignificant	• Long-term, significant scouring of wetlands • Long-term, significant alteration of hydrology

Resource	Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles	Alternative 2: No Action
	increase in sedimentation to upstream wetlands	
Floodplain Resources	• Long-term, negligible construction within floodplain	• Long-term, significant flooding of floodplain
Water Resources	• Long-term, non-permanent, minimal turbidity and insignificant to minimal sedimentation	• Long-term, significant sedimentation • Long-term significant water quality impacts
Air Quality Resources	• Short-term, minor impact on regional greenhouse gas budget • Long-term, non-permanent, moderate impacts on air quality during construction	• Long-term, non-permanent, moderate impacts on air quality during construction
Noise Quality Resources	• Long-term, non-permanent, moderate adverse impacts on ambient noise environment	• Long-term, non-permanent moderate adverse impacts on ambient noise environment
Geological Resources	• Long-term, negligible impact to shale and sandstone	• Long-term, negligible impact to shale and sandstone • Long-term, significant slope failure, debris avalanches and landslide deposits
Soil Resources	• Long-term, negligible erosion in areas cleared for construction • Long-term insignificant increase in soil deposition and displacement upstream of the dam	• Long-term, significant soil displacement, erosion and scouring
Recreation Resources	• Long-term, non-permanent, moderate impacts to upstream sites due to inundation • Long-term, significant loss of downstream recreation including river access • Long-term, non-permanent, moderate impacts to Hinton City Park • Long-term, non-permanent, minimal reduction in fishing quality	• Long-term, non-permanent, moderate impacts to Hinton City Park • Long-term, significant loss of upstream and downstream recreation facilities and fishing quality

Resource	Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles	Alternative 2: No Action
	• Long-term, non-permanent, moderate impact to recreation economy	
Visual/Aesthetic Resources	• Long-term, minimal impact to visual character of dam • Long-term, non-permanent, moderate disruption of visual character of tailwater flow. • Long-term, permanent negligible loss of downstream viewing opportunity • Long-term, non-permanent, moderate reduction in aesthetic enjoyment of surrounding area	• Long-term, significant visual disturbance from flood impact • Long-term, non-permanent, moderate reduction in aesthetic enjoyment of surrounding area
Cultural Resources	• Long-term potential adverse impacts to cultural resources upstream of dam • No adverse impacts to cultural resources downstream of dam	• No adverse impacts to cultural resources upstream of the dam • Significant adverse impacts to cultural resources downstream of the dam
Socioeconomic Resources	• Long-term, non-permanent, moderate increase in local construction jobs • Long-term, minimal decrease in local tourism business revenue • Long-term, non-permanent reduction in community cohesion and property value due to noise • Long-term increase in community cohesion due to reduction in risk of dam failure • Long-term, non-permanent, moderate impact on transportation	• Long-term, non-permanent, significant impact on socioeconomics including schools, transportation, community cohesion
Public Safety Resources	• Long-term, positive impact on public safety due to reduced risk of dam failure	• Long-term significant risk to public safety

Resource	Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles	Alternative 2: No Action
Hazardous, Toxic, and Radioactive Waste	• Minimal risk of release	• Increased risk of release
Other Social Effects	• Long-term, non-permanent, minimal to significant impact on group identity, social connectedness, economy, leisure, and recreation	• Long-term and minimal to significant impact on group identity, social connectedness, economy, leisure, and recreation

3.7 Commitments and Mitigation Measures

USACE would inform the community of planned construction activities on a routine basis, so that residents would know what to expect and can plan accordingly. Also, the USACE would institute a complaint mechanism and feedback to resolve issues of concern.

BMPs would be used in all facets of construction to minimize the introduction of contaminants or suspended solids into area surface waters, such as erosion control devices and siting equipment staging, fueling, and maintenance areas outside of wetlands, streams and riparian areas.

The USACE contractor would use BMPs as standard operating procedures during all construction activities, including proper handling, storage, and/or disposal of hazardous and regulated material. The contractor would be responsible for any hazardous waste generated during construction and would also be required to collect, characterize, label, store, transport, and dispose of all non-recyclable hazardous and regulated wastes, as regulated by the USEPA, to comply with RCRA and other applicable laws and regulations. Fuel, lubricants, and oil would be managed and stored in accordance with all Federal, state, and local laws and regulations. The refueling of machinery would be completed following accepted USACE guidelines, and all vehicles would have drip pans to contain minor spills and drips.

During construction of the TSP, proper and routine maintenance of all vehicles and other construction equipment would be implemented to ensure that emissions are within the design standards of all construction equipment. Dust suppression methods should be implemented to minimize fugitive dust. In particular, wetting solutions would be applied to the construction area, including the concrete batch plant, to minimize the emissions of fugitive dust. In addition, maintenance of filters at the concrete plant would be followed and equipment and procedures to contain concrete dust generated during transfer and storage would be developed.

Flagmen, signage, cones, barricades, and detours would be used where required to facilitate movement of construction equipment, construction materials, and local traffic on affected road segments. In addition, road damage resulting from heavy truck and machinery traffic would be repaired as part of the project. Truck traffic delivering materials through Bellepoint and other residential areas would be limited to the hours of 9:00 a.m. to 2:00 p.m., Monday through Friday.

Tree cutting would be minimized by clearing in previously disturbed areas. Seasonal restrictions for tree clearing would be followed to prevent taking bird nests, eggs, and young (between September 1 and March 31, which is outside the nesting season for most native bird species). River banks and slopes that are directly disturbed by construction activities would be revegetated with native trees and shrubs, replacing lost habitat for terrestrial species.

In order to minimize the risk of introduction of invasive mussels into the New River, all construction boats would be decontaminated prior to use within the New River. The portion of the cofferdam to be built outside of the stilling weir would be constructed during low or no flow conditions, and would include impervious material on the west side, to minimize the risk of cofferdam material such as rock and gravel from moving into downstream aquatic habitat.

If USACE discovers historic properties or archeological sites without prior planning or unanticipated effects on historic properties or archeological sites are found after USACE has completed the Section 106 process, USACE would make reasonable efforts to avoid, minimize, or mitigate adverse effects to such properties or sites pursuant to 36 CFR 800.13(b). If no construction has commenced, USACE will consult with WVSHPO to resolve adverse effects pursuant to 36 CFR 800.6. If construction has commenced, USACE would determine actions to take to resolve adverse effects, and notify WVSHPO within 48 hours of discovery. The notification shall describe the actions proposed by USACE to resolve the adverse effects. WVSHPO shall respond within 48 hours of the notification and USACE shall take into account his/her recommendations and carry out appropriate actions. USACE will provide WVSHPO a report of the actions when they are completed pursuant to 36 CFR 800.13(b)3.

Mitigation under the TSP would include completion of any approved mitigation activities approved and funded which have not yet been completed, as described in Section 3.5.1. Additionally, the following mitigation for the impacts under the TSP would be completed.

Mitigation for the removal of the tailwater fishing pier would include the construction of a replacement access point for fishing downstream of the dam. Several alternative locations on both left and right side banks and configurations of such a replacement fishing pier are currently under consideration. One or more of these alternative locations and configurations would be implemented to mitigate for the loss of fishing access due to construction. USACE is committed to replacing the existing ADA-accessible public fishing pier in the same approximate location when the TSP and DSA construction is complete. USACE would also consider additional opportunities upstream of the dam to provide additional access to the water to mitigate for significate losses to recreation within the downstream areas.

The USFWS policy for Resource Category 1 habitat is to recommend avoidance of all impacts, but because alternatives are not available to avoid these impacts for the Bluestone Dam Safety project, the USFWS has decided to seek a net gain in conservation as an outcome on this project. In addition to the impact minimization efforts and restoration of disturbed fish habitat and water willow replanting, the USFWS has recommended off-site mitigation for the 50.94 aquatic Habitat Units (HUs) impacted at a site, yet to be determined, that meets at least three of the following five criteria:

1. The site should be adjacent to the New River (river front property). The site can either have intact riparian buffers, and receive mitigation credit for preservation, or lack riparian buffers and receive credit for restoration.

2. The site should contain direct tributaries to the New River that are in need of restoration or enhancement. Restoration work can include, but is not limited to, livestock fencing, stream restoration work, enhancement of riparian buffer to reduce erosion (tree/shrub planting), and/or removal of barriers to fish passage.

3. The site should be significantly forested or have the potential to be replanted to improve riparian buffers.

4. There is the ability to secure the mineral and development rights for the site to ensure that it will not be developed in the future.

5. The site should be adjacent to another conservation area (e.g., Wildlife Management Area, State Park, or federally protected land).

The final mitigation plan for aquatic resource impacts would be developed in coordination with USFWS and would be implemented concurrent with construction of the TSP. USACE has identified several opportunities upstream and downstream of the dam which provide feasible options to achieve mitigation needs. Coordination is ongoing with the resource agencies to further optimize conceptual mitigation plan to demonstrate feasibility within the Final Environmental Impact Statement. Refer to Chapter 7 for additional detail on mitigation commitments.

4.0 AFFECTED ENVIRONMENT

4.0 AFFECTED ENVIRONMENT

This section of the SDEIS describes the natural and human environment that exists in and surrounding the Bluestone Dam and the potential effects on those resources as a result of the Proposed Action and No Action alternatives. Only those parameters that have the potential to be affected by the Proposed Action and No Action alternatives are described, as per CEQ guidance (40 CFR 1501.7 [3]). Information presented in this chapter regarding the affected environment has been adapted and updated from the original Bluestone Lake 1998 DSAS FEIS.

The discussions to follow provide the existing conditions of those significant resources associated with the Bluestone Dam and surrounding area.

4.1 Botanical Resources

In this section of the SDEIS, botanical resources in the study area are described. In addition, federally listed threatened and endangered species, species of concern and State listed sensitive plant species are identified.

4.1.1 Investigative Methods and Resources

The botanical resources in the study area were characterized using existing literature, previous studies of the project area and coordination with USFWS (USFWS 2014).

4.1.2 Inventory of Botanical Resources

4.1.2.1 Description of Vegetation

The project area falls within the eastern deciduous forest biome (Yahner 2000), a biome which is dominated by deciduous trees – broad leaved trees which lose their foliage each winter. The vegetation ranges from old growth forests to wetlands, and is a function of habitat, elevation, geology, soil, moisture and human activities. Habitats are similar at like elevations in the study area, and species assemblages vary depending on relative humidity, with mesic habitats having higher ground story species richness than xeric habitats (Perles 2010). The study area around the New River upstream and downstream of the Bluestone Dam is considered an ecotone of the northern boundary for southern plant species and the southern boundary for northern plant species, contributing to the area's overall botanical diversity (NPS 2009a). While a majority of the area outside of the small towns is forested, a small portion has been developed into agricultural fields and pastures.

4.1.2.1.1 Upstream of Bluestone Dam

Rentch *et al.* (2005) conducted vegetation sampling of a 2,100-hectare study area encompassing the area surrounding the Bluestone National Scenic River, including portions of the Pipestem Resort State Park, the Bluestone Wildlife

Management Area, and Bluestone State Park, all of which are upstream of the Bluestone Dam along the Bluestone River and partially within the study area. The study provided a snapshot of the range of major forest cover types present at various topographic locations in the upstream area, ranging from near the river at the bottom of the gorge to the upper slope near the rim of the gorge. The research team developed community types based on the two or three most dominant tree species, and characterized the species assemblages found in these communities. Species of oaks (*Quercus spp.)* are the most common overstory species in the area, with white oak (*Q. alba)* being the most common; however, sugar maple (*Acer saccharum*) and red maple (*A. rubrum)* abundance in the understory of many communities suggests that they may increase in dominance in the future in some of the study area, as fire suppression and timber harvest over the last 50 years may have contributed to limited oak regeneration. Similar vegetation studies upstream and downstream of the Bluestone Dam found similar oak overstory dominance with maple understory, indicating a shift in dominance as the forests in this area mature over time (Rentch *et al.* 2005; Perles *et al.* 2010).

While not all of the communities discussed by Rentch (2005) are described here, the following discussion offers a summary of the range of species along the slopes of the study area and the predominant species and vegetation communities found upstream of the dam. On the upper-slopes and ridgetops of the Bluestone River area, Rentch (2005) documented Sourwood-Shagbark-Black oak communities dominated by sourwood (*Oxydendron arboretum)*, and abundant red maple and hickory (*Carya ovata)*. On the mid and upper portions of slopes, Rentch documented a White oak-Northern red oak-Black oak community, dominated by chestnut oak (*Q. prinus*), sugar maple and hickory in the overstory, with blueberry (*Vaccinium palladium*), huckleberry (*V. stanineum*), early sedge (*Carex pennsylvanica* Lam.) and common cinquefoil (*Potentilla simplex)* in the herbaceous and shrub layer. Also in the mid-slope to upper slope positions, Rentch documented Chesnut oak-Northern red oak-Red Maple communities. The overstory of these communities was dominated by chestnut oak and red oak, with sugar maple and American beech (*Fagus grandifolia*) present in the small tree stratum. Mountain laurel

Mixed mesophytic forest typical of project area.
Photo courtesy of NPS

(*Kalmia latifolia*), black huckleberry (*Gaylussacia baccata)*, blueberry, and Umbellate Wintergreen (*Chimaphila umbellate)* were also common in this community.

In mid-slope areas, in which timber harvest occurred in the 1940s, a White Pine-Mixed Oak community is found, consisting of white pine (Pinus strobus) red oak, white oak, black oak (*Q. velutina)*, sourwood and red maple, with an herbaceous stratum dominated by eastern teaberry (*Gaultheria procumbens*), Christmas fern (*Polystichum acrostichoides)* and sedges such as early sedge*.*

Flowering Dogwood.
Photo courtesy of Jan Miller, USFWS

In the mid-slope to lower slope sample sites, the Sugar maple-Northern red oak-Eastern hemlock communities consists of sugar maple, white turtle head (*Chelone glabra)*, white ash (*Faxinus Americana)*, and eastern hemlock (*Tsuga Csanadensis)*. Walking spleenwort (*Asplenium xebenoides)* and chinkapin oak (*Quercas muehlenbergii)* were present in these communities as well. Yellow poplar-Sugar maple-Cucumber magnolia communities were also documented in the lower to mid-slope regions of the study area, consisting of tulip tree (*Liriodendron tulipfera)*, sugar maple, and blue magnolia (*Magnolia acuminata)*. Also in the lower elevations of the study area, Rentch (2005) documented White ash-Basswood-Northern red oak communities with common buckeye (*Aesculus flava)*, American basswood (*Tilia Americana),* and sugar maple found in the tree strata.

A floristic survey study conducted by the National Park Service in the Bluestone National Scenic River Park area, identified 786 vascular plant taxa representing 762 species (Smiths *et al.* 2008). The most abundant native species identified in this survey include Christmas fern, eastern poison ivy (*Toxicodendron radicans*) white wood aster (*Eurybia divaricata*), mapleleaf viburnum (*Viburnum acerifolium*), woodland stonecrop (*Sedum ternatum*), fourleaf yam (*Dioscorea quaternata*), American hogpeanut (*Amphicarpaea bracteata*), eastern redbud (Cercis canadensis), black locust (*Robinia pseudoacacia*), American witch hazel (*Hamamelis virginiana*), tulip tree, fragrant bedstraw (*Galium triflorum*), and Virginia creeper (*Parthenocissus quinquefolia*).

Crump's Bottom is the largest naturally occurring wetland within the study area upstream of the dam on the New River. The periodic flooding caused by floodwater retention within Bluestone Lake upstream of the dam does not seem to have changed the essential character of the naturally occurring bottomlands surrounding the lake (NPS 2009a); however, siltation at the head of the dam's normal pool does negatively impact the wetlands in the Crump's Bottom area (USFWS 2014). Additional details regarding species commonly found in wetlands within the study area are provided in Section 4.4, Wetland Resources.

Riparian vegetation on Bluestone Lake

Botanical resources within the lower elevations of the upstream project area within the limits of Bluestone Lake are comprised in part of species which are generally adapted for periodic, short term inundation. The minimum pool elevation is 1,406 feet (winter pool), the seasonal pool is elevation 1,410 (summer pool), the flood control pool is elevation 1,520. In most years, the lake experiences an average of 18 days a year out of pool. The low range out of pool event is 1,411 feet, the pool of record is 1,506 feet, and the average pool over the last 66 years is 1,443 feet.

4.1.2.1.2 Downstream of Bluestone Dam

Similar vegetation studies have been completed on the portion of the New River downstream of Bluestone Dam within the New River Gorge, one of which (Vanderhorst *et al.*, 2007) identified 41 vegetation community types in the area, demonstrating the vegetative diversity and abundance in the study area. The upper slopes of this area are dominated by Oak-Hickory Forest communities, consisting of species such red oak, black oak, white oak, and bitternut hickory (*Carya cordiformis*). Mid-slope areas are largely occupied by Oak-Hickory Sugar Maple communities, as well as plant communities associated with cliff faces such as Virginia pine (*Pinus virginiana*), mountain spleenwort (*Asplenium montanum*), great laurel (*Rhododendron maximum*), smooth hydrangea (*Hydrangea arborescens*) and herbaceous species such as American alumroot (*Heuchera Americana*). Lower slopes of the gorge contain Sugar maple-Yellow-Buckeye-American Basswood Forest communities and Tulip tree-Mixed oak-Sugar maple communities (Suiter 1999; Vanderhorst *et al.*, 2007).

Additional tree species found in the study area downstream of the dam include boxelder (*Acer negundo*), river birch, bitternut hickory, green ash (*Fraxinus pennsylvanica*), black walnut (*Juglans nigra*), flowering dogwood, and American sycamore (*Platanus occidentalis*) (Streets *et al.* 2008). Bushes common throughout the area include spicebush, autumn olive (*Elaeagnus umbellata*), rhododendrons (*Rhododendron spp*), blueberries, huckleberries, and mountain laurel (Perles 2010).

Bottomland hardwood vegetation within the riparian areas and floodplain downstream of the dam include similar bottomland species as those seen upstream of the dam, as well as sycamore, green ash, creeping jenny (*Lysimachia nummularia*), narrowleaf bittercress (*Cardamine impatiens*), tunhoof (*Glechoma hederacea*), river birch, and common three square (*Schoenoplectus pungens*) (NPS 2009a; Vanderhorst 2007). The New River Gorge area also contains a number of streamside communities that are subject to inundation and occasional high water, such as S. nigra-B. nigra Stream Bed communities, Saururus cernuus Silt Accumulation communities, and Platanus occidentalis-Betula nigra Forest communities (Suiter 1999). Riparian vegetation communities are more common upstream of Gauley Bridge than they are downstream of Gauley Bridge, where the river channel begins to narrow and wide floodplain habitats become more rare (USFWS 2014).

Rosa multiflora.
Photo courtesy of Invasive Plant Atlas of New England

The USFWS (2014) notes that several unusual riparian habitat types occur in the southern portion of the New River Gorge downstream of the dam. One site consists of a canopy dominated by Virginia Pine and quaking aspen (*Populus tremuloides*). Another unusual community, a talus slope near the I-64 bridge, is dominated by eastern hemlock (*Tsuga canadensis*) and hardwoods usually seen in more upland areas. A globally rare community, the Appalachian Rivers Flatrock Community, occurs on flat sandstone ledges at three locations downstream of the dam: Camp Brookside, Sandstone Falls, and Keeney Creek. These unusual communities provide habitat for rare species tracked by WV Natural Heritage Program, including arrowfeather threeawn (*Aristida purpurascens var. purpurascens*), pretty sedge (*Carex woodii*), whitemouth dayflower (*Commelina erecta var. angustifolia*), star tickseed (*Coreopsis pubescens var. robusta*) (in ecotone with mowed field), downy milkpea (*Galactia volubilis*), coppery St. Johnswort (*Hypericum virgatum*), twoflower melicgrass *(Melica mutica*), and blackseed speargrass (*Piptochaetium avenaceum*). (Vanderhost *et al.* 2007).

Common exotic species, which are potential significant threats to the study area's native plants, include Queen Anne's lace (*Daucus carota*), common dandelion (*Taraxacum officinale*), and coltsfoot (*Tussilago farfara*) (Streets *et al.* 2008). Tree of heaven (*Ailanthus altissima*) is a common exotic species along the floodplains and lower slopes of the area (Perles 2010). Multiflora rose (*Rosa multiflora*) has been identified as the most common invasive exotic species within the New River George and Gauley Bridge areas (Perles 2010).

4.1.2.2 Federally-Listed Endangered and Threatened Species and Species of Concern and State-Listed Sensitive Plant Species

Three federally listed plant species may occur in the study area (Table 4-1). Running buffalo clover (*Trifolium stoloniferum*) is Federally and state listed as endangered. Although USFWS (2014) notes that suitable habitat for the species (partially shaded woodlots, mowed areas and along streams and trails) exists from Gauley Bridge, WV to Bluff City, VA, with the exception of the full-sun and full-shade areas just downstream of the dam, the floristic survey of Bluestone River (Streets 2009) did not identify any occurrences of the plant in that area. A disjunct population of running buffalo clover is known to occur at the mouth of the New River where it joins the Kanawha River, but suitable habitat is not likely to occur downstream of Gauley Bridge (USFWS 2014).

Running buffalo clover.
Photo courtesy of USFWS; Sarena Selbo

Table 4-1. Federal and State Endangered and Threatened Species in Project Area

Scientific Name	Common Name	Federal Status	State Status	Potential to Occur in Project Area
Running buffalo clover	*Trifolium stoloniferum*	Endangered	Endangered (WV, VA)	Possible upstream of Gauley Bridge; known population at mouth of New River at confluence of Kanawha
Virginia spiraea	*Spiraea virginiana*	Threatened	Threatened (WV, VA)	Upstream of Gauley Bridge
Peters mountain mallow	*Iliamna corei*	Endangered	(Endangered (VA)	Single occurrence, Giles County, VA
Bentley's coralroot	*Corallorhiza bentleyi*	n/a	Endangered (VA)	Known occurrences in Monroe County, WV
Long-stalked holly	*Ilex collina*	n/a	Endangered (VA)	Possibly present, High elevation wetlands

Virginia spiraea (*Spiraea virginiana*) is Federally-listed as threatened. The 1998 DSAS FEIS noted a steep decline in observed plants between 1988 and 1996. However, the USFWS (2014) notes that the species is known to occur along parts of the Bluestone National Scenic River in Mercer County and along portions of the New River Gorge National River in Nicholas County. Suitable habitat for this species does not exist downstream of Gauley Bridge, and no known populations have been identified in this area.

A total of 35 locations have been noted for Virginia spiraea in Mercer and Summers Counties along the Bluestone River, including five now extirpated locations. Populations at two of the sites selected for biennial monitoring have been extirpated; one due to erosion and one due to submergence. Other populations are threatened by invasive species such as purple loosestrife and severe overgrazing by deer.

Virginia spiraea.
Photo courtesy of U.S. Forest Service; T.G. Barnes

There are 24 occurrences of Virginia spiraea along the Meadow River in Nicholas and Fayette Counties, where biennial monitoring indicates a total extent of population increase since 1996; however, the percent of Virginia spiraea covered within that area in 2005 has decreased by 29 percent, indicating the species may be stable but more dispersed and likely has excellent viability.

There are approximately 50 occurrences of the species along the Gauley River in Nicholas and Fayette Counties. While biennial monitoring since 1996 indicates that the population appears to be stable to increasing, populations are threatened by all-terrain vehicle use and the encroachment of non-native invasive species such as Japanese knotweed (USFWS 2014).

WV does not have state threatened and endangered species legislation; therefore, the species considered as either threatened or endangered in the state are those listed as Federally threatened and endangered species. Virginia's Department of Agriculture and Consumer Services, however, maintains a state list of endangered and threatened plant species that augments the Federal list.

Peters mountain mallow (*Iliamna corei*), Federally and Virginia state-listed as endangered, is known to have a single occurrence in Giles County, VA, upstream of Bluestone Dam. This single population is located near the ridgeline of the Narrows Preserve on Peters Mountain above the New River, at approximately elevation 3,000 feet. The population is threatened by fire suppression, overgrazing by wildlife and feral livestock, and collection by people (Natureserve 2015; VNHP 2008).

Bentley's coralroot.
Photo courtesy of Milo Pyne, iNaturalist,org

Bentley's coralroot (*Corallorhiza bentleyi*), Virginia state-listed as endangered, is often found at the edge of mixed upland hardwood forests, where these habitats meet disturbed areas such as roads (Natureserve 2015) This species also has occurrences in Monroe County, WV, upstream of Bluestone Dam. Long-stalked holly (*Ilex collina*), also a Virginia state-listed endangered species, is found in high elevation wetlands.

Several Virginia state-listed species of concern could also be present within the project area. The Virginia Natural Heritage Program identifies Canby's Mountain-lover (*Paxistima canbyi*), Tennessee Pondweed (*Potamogeton tennesseensis*), and Torrey's Mountain-mint (*Pycnanthemum torreyi*) as species of concern found in Giles County, VA. Canby's mountain-lover is typically found on limestone outcrops, cliffs, ridgebacks, barrens, and talus (Natureserve 2016). Tennessee pondweed is an aquatic perennial herb found in river shallows and streams. Torrey's Mountain-mint is often found in upland dry forests and along streams.

The WV Natural Heritage Program (WVNHP) tracks rare plants of conservation concern, based on the NatureServe database, which classifies species according to their state and global rarity. Species classified as S1 have five or fewer documented occurrences, or very few remaining individuals within the state. They are extremely rare and critically imperiled, and/or especially vulnerable to extirpation. Species classified as S2 have six to 20 documented occurrences, or few remaining individuals within the state. Such species are considered very rare and imperiled and vulnerable to extirpation. Species classified as S3 have 21 to 100 documented occurrences and may be somewhat vulnerable to extirpation. Species classified as SH are considered historical species which have not been located within the last 20 years, but may be rediscovered. Globally imperiled species (classified as G1) typically have 6 to 20 occurrences or few remaining individuals (1,000 to 3,000). Species that are globally vulnerable (classified as G2) typically have 21 to 100 occurrences or between 3,000 and 10,000 individuals. (NatureServe 2016).

There are 136 species of rare plants (state-ranked as S1, S2, S3, G1, or G2) tracked by the WVNHP which are known to exist within the project area, specifically in the Gauley River National Recreation Area, New River Gorge National River, and/or Bluestone National Scenic River. Appendix B lists these species, their ranking, and their known occurrences within these three areas.

Twelve plants considered globally vulnerable or imperiled are either present of likely to occur within the project area: Buffalo clover, nodding onion (*Allium oxyphilum*), spreading rock-cress (*Arabis patens*), American barberry (*Berberis canadensis*), bitter cress (*Cardamine flagellifera*), Appalachian gentian (*Gentiana austromontana*), Torrey's mountain-mint (*Pycnanthemum torrei*), Carey saxifrage (*Saxifraga careyana*), rock skullcap (*Scutellaria saxatilis*), Virginia mallow (*Sida hermaphrodita*), nodding pogonia (*Triphora trianthophora*), and sand grape (*Vitis rupestris*). Three additional plants considered globally vulnerable or imperiled are either present of likely to occur only downstream of Gauley Bridge within the project area: turgid gay-feather (*Liatris turgida*), Barbara's buttons (*Marshallia grandiflora*), and Appalachian Blue Violet (*Viola appalachiensis*) (USFWS 2014).

4.2 Zoological/Wildlife Resources

This section describes the terrestrial and avian zoological/wildlife resources found within the study area, with an emphasis on Federally listed threatened and endangered species and State listed sensitive species. With the exception of two aquatic salamanders discussed in this section, aquatic species are discussed in Section 4.3.

4.2.1 Investigative Methods and Resources

The investigation conducted for preparation of this section relied upon existing literature and coordination with the USFWS.

4.2.2 Inventory of Zoological/Wildlife Resources

4.2.2.1 Description of Wildlife and Wildlife Habitat

The diversity in habitat throughout the New River Gorge, Bluestone Wildlife Management Area, and Bluestone National Scenic River is mirrored in the rich diversity of wildlife species which inhabit the study area. The portion of the study area nearest to the dam supports the greatest diversity of wildlife, as greater human development such as cities, agriculture, and industrial development is more prevalent downstream of Gauley Bridge.


Eastern chipmunk.
Photo courtesy of Tanya Dewey, Animal Diversity Web

Species such as white-tailed deer (*Odocoileus virginianus*), eastern chipmunk (*Tamias striatus*), black bear (*Ursus americanus*), eastern gray squirrel (*Sciurus carolinensis*), red squirrel (*Tamiasciurus hudsonicus*), fox squirrel (*Sciurus niger*), cottontail rabbit (*Sylvilagus floridanus)*, big brown bat (*Eptesicus fuscus*), little brown bat (*Myotis lucifugus*), woodchuck (*Marmota monax)*, pygmy shrew (*Sorex hoyi*), common raccoon (*Procyon lotor)*, gray fox (*Urocyon cinereoargenteus*), red fox (*Vulpes vulpes*), American beaver (*Castor canadensis*), Virginia opossum (*Didelphis virginiana*), muskrat (*Ondatra zibethicus*), longtail weasel (*Mustela frenata*), striped skunk (*Mephitis mephitis*), bobcat (*Lynx rufus*), otter (*Lontra canadensis*) and mink (*Neovison vison*) are some of the wildlife known to inhabit the study area (NPS 2009; WVDNR 2005).

Five lined skink.
Photo courtesy of James Harding, Michigan State University

The New River Gorge is part of the north-south migratory flyway for neo-tropical migrant birds, and is home to numerous resident species. The diverse assemblage of bird species in the project area, approximately 218 different species (NPS 2009a), includes wild turkey (*Meleagris gallopavo*), ruffed grouse (*Bonasa umbellus*), mourning dove (*Zenaida macroura*), ruby-throated hummingbird (*Archilochus colubris*), several woodpecker species (*Melanerpes and Picoides spp)*, tundra swan (*Cygnus columbianus*), various ducks and mergansers (*Mergus and Lophodytes spp*.), chimney swift (*Chaetura pelagica*), brown thrasher (*Toxostoma rufum*), indigo bunting (*Passerina cyanea*), Baltimore oriole (*Icterus galbula*), and magnolia warbler (*Setophaga magnolia*) among many others. Several species in the hawk and eagle family are found in the project area, including bald eagle (*Haliaeetus leucocephalus*), red-tailed hawk (*Buteo jamaicensis*), Cooper's hawk (*Accipiter cooperii*) and golden eagle (*Aquila chrysaetos*) (NPS 2016a).

Numerous species of amphibian and reptile have been documented within the New River Gorge National River and Bluestone River, including spring peepers (*Pseudacris crucifer*), wood frogs (*Lithobates sylvaticus*), red spotted newts (*Notophthalmus viridescens viri-descens*), dusky salamander (*Desmo-gnathus fuscus*), seal salamanders (*Desmognathus monticola*), copperhead snake (*Agkistrodon contortrix*), black rat snake (*Elaphe obsoleta obsolete)*, fence lizards (*Sceloporus undulatus*), five-lined skinks (*Plestiodon fasciatus*), garter snakes (*Thamnophis sirtalis*), eastern box turtles (*Terrapene carolina carolina*), American toads (*Bufo americanus)*, and ringneck snakes (*Diadophis punctatus*) (NPS 2016b).

4.2.2.2 Federally-Listed Endangered and Threatened Species and Species of Concern and State-Listed Sensitive Zoological/ Wildlife Species

Federal and state-listed endangered and threatened species which may occur in the project area are listed in Table 4-2.

Table 4-2. Federal and State-Listed Threatened and Endangered Species

Common Name	Scientific Name	Federal Status	State Status
Indiana bat	*Myotis sodalis*	Endangered	Endangered (WV)
Virginia big-eared bat	*Corynorhinus townsendii virginianus*	Endangered	Endangered (WV)
Northern long-eared bat	*Myotis septentrionalis*	Threatened	None
Peregrine falcon	*Falco peregrinus*	None	Threatened (VA)

Indiana bat.
Photo courtesy of USFWS, Ann Froschauer

Indiana bats are insectivorous, migratory bats that hibernate colonially in the winter in caves and mines. In the spring, reproductive females migrate to wooded areas to birth and raise young, while males and nonproductive females do not form large colonies and instead stay close to their hibernacula alone or in small groups. These reproductive bats roost under loose bark on dead or dying trees (USFWS 2014; USFWS 2007). Habitats in which maternity roosts occur include riparian zones, bottomland and floodplain habitats, wooded wetlands, and upland communities. Indiana bats typically forage in semi-open to closed (open understory) forested habitats, forest edges, and riparian areas (USFWS 2007).

Habitat for Indiana bat winter hibernation and summer roosting occurs throughout the project area. Although maternity colonies have not been detected in the New River Gorge National River, Gauley River National Recreation Area, or Bluestone National Scenic River, their presence in the project area could be reasonably expected given the echolocation calls documented by Castleberry *et al.* (2007) and the maternity roosts found in the vicinity of the parks. Castleberry *et al*., (2007) also notes that Indiana bats seem to show a roosting preference for closed canopy riparian areas.

The Virginia big-eared bat is one of two endangered subspecies of Townsend's big-eared bat. Virginia big-eared bats are non-migratory, using caves and mines such as those found in the project area throughout the year rather than just for hibernation, though individuals and populations may use different caves for summer and winter. Like Indiana bats, reproductive females form colonies in the spring to rear their young. These bats forage for insects along forest edged and small forest openings (USFWS 2011).

Suitable habitat and foraging areas for Virginia big-eared bats are found within the project area from Bluff City, VA to Poca, WV. The occurrence of these bats in the New River Gorge National River between Sandstone and Gauley Bridge has been previously documented (USFWS 2014; Castleberry *et al.* 2007; Varner 2008). Although no large colonies of this species have been documented in the project area, a population large enough to maintain a distinct genetic population in the New River area likely exists (Piaggio *et al.* 2008).

The northern long-eared bat was added to the Federal list of threatened species in 2015 due to declines caused by white-nose syndrome. The project area falls within the range of the northern long-eared bat, including Summers County in which Bluestone Dam is located (USFWS 2016). Like the other bats in the project area, the northern long-eared bat hibernates in caves and mines in the winter, and roosts and forages in upland forests during the summer.

Peregrine falcon.
Photo courtesy of James Dowling-Healey, Animal Diversity Web

The peregrine falcon was federally delisted in 1999, but remains on the Virginia list of threatened species. This species is known to nest in holes or on ledges of cliff faces (Natureserve 2016). Efforts to re-introduce the species to the project area included the relocation of nests to the New River Gorge and the release of 120 reared young into the area between 2006 and 2011 (Perrone 2011). A 2006 survey (Watts 2006) found that while the New River Gorge from Gauley Bridge to Bluestone Lake contains extensive sections of exposed rock that could serve as prime peregrine falcon nesting, no nests were observed there during the survey. The species has been observed in the New River Gorge and could potentially nest in cliff faces within the project area upstream of Gauley Bridge, but no current or historical nesting records exist for the New River Gorge National River (NPS 2009a).

Bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c), which prohibits the taking of these birds, their nests or their eggs. “Taking” under this act includes not just killing of a bird, but also disturbing individual birds to a degree that causes or is likely to cause injury to the eagle, decrease its productivity, or abandon its nest.

Bald eagles are known to be present year-round in the project area. Individuals have been seen foraging in the vicinity of the dam, and nests were previously documented within the immediate vicinity of the New River on Brooks Island, near Beury, WV and near Bull Falls, WV, as well as elsewhere within Monroe and Greenbier Counties (USFWS personal communication). Bald eagle population numbers are thought to be increasing throughout the project area (USFWS 2014). Golden eagles are known to migrate through the project area, with some individuals overwintering in the area (USFWS 2014).

The osprey (*Pandion haliaetus*), although not Federally-listed as endangered or threatened or otherwise protected under Federal law, is considered a species of concern by USFWS. Individuals have been sporadically seen throughout the project area between Bluff City, WV and Gauley Bridge (USFWS 2014).

Yellow bellied sapsucker.
Photo courtesy of Phil Myers, Museum of Zoology, University of Michigan-Ann Arbor

Migratory birds that pass through the project area are protected by the Migratory Bird Treaty Act (16 USC 760c-760g), as amended. Over 60 of these protected migratory species which have been identified within the Bluestone National Scenic River and New River Gorge National River are considered species of concern by the WV Department of Natural Resources.

The USFWS has identified Birds of Conservation Concern (BCC) which it regards as the highest conservation priorities among migratory and non-migratory birds, aside from those Federally listed as endangered or threatened. Sixteen BCC species, listed in Table 4-3, may occur within the project area.

The avian species with the smallest statewide populations and declining trends that are believed to be present between Bluff City, WV and Sandstone are the golden winged warbler (*Vermivora chrysoptera*), Swainson's warbler (*Catharus ustulatus*), red-headed woodpecker (*Melanerpes erthrocephalus*), and yellow bellied sapsucker (*Sphyrapicus varius*). Golden winged warblers are likely to occur in low second-growth forests and open woodlands; Swanson's warblers prefer floodplain and bottomland hardwood forests; red-headed woodpeckers prefer open oak groves; and yellow bellied sapsuckers are found in mixed hardwood forests. However, these species are not expected to be found in the tailwater habitat immediately downstream of the dam.

The USFWS has been petitioned to list the eastern small-footed bat (*Myotis leibii*), little brown bat, and Eastern hellbender (*Cryptobranchus alleganiensis*), all of which may occur within the project area. The eastern small-footed bat and little brown bat hibernate in caves and mines in the winter, and roost in cliff faces, loose bark or tree hollows in the summer (Natureserve 2016). Eastern hellbender is a fully aquatic salamander found in the mainstem and tributaries of the New River (VDGIF 2016).

Table 4-3. Birds of Conservation Concern with Possible Occurrence in Project Area

Common Name	Scientific Name	WV Population Estimates	Habitat Type	Nesting Sites	Reason for Decline	Recon. Area	Tailwater Area
Whip-poor-will	*Caprimulgus vociferous*	20,000	Hardwood-hemlock or hardwood white pine forests	On the ground among dead tree leaves	Loss of open-understory forests	1,2,3,4	Not Likely to Occur
Red-headed Woodpecker	*Melanerpes erythrocephalus*	300	Open oak groves with little understory cover	Dead trees or dead parts of live trees	Loss of nut-producing trees and availability of dead trees in open-forest habitats	1,2,3,4	Not Likely to Occur
Black-capped Chickadee	*Poecile atricapillus*	110,000	Mixed deciduous-coniferous and Northern hardwood forests	Dead standing trees, fence posts, bird boxes, old woodpecker holes and natural cavities		1,2	Likely to Occur
Wood Thrush	*Hylocichla mustelina*	920,000	Mature or near mature deciduous forests	Fork or horizontal branch 2 to 15 meters above the ground	Habitat fragmentation in both breeding and wintering grounds	1,2,3,4	Not Likely to Occur

Common Name	Scientific Name	WV Population Estimates	Habitat Type	Nesting Sites	Reason for Decline	Recon. Area	Tailwater Area
Blue-winged Warbler	*Vermivora cyanoptera*	70,000	Second-growth woodlands, brushy areas and power line right-of-ways	Ground or in a low bush		1,2	Not Likely to Occur
Golden-winged Warbler	*Vermivora chrysoptera*	6,000	Low second-growth forests, open woodlands and power line right-of-ways	Ground or in a low bush	Habitat loss, hybridization, competition with the closely related Blue-winged Warbler, and invasive Phragmites	1,2	Not Likely to Occur
Prairie Warbler	*Dendroica discolor*	50,000	Young pine forests, young second growth hardwood, over grown pastures and other brushy scrub areas	Shrubs or in the lower branches of pine or cedar trees	Loss of breeding habitat through development and natural change of shrubby habitat to forest	1,2,3,4	Not Likely to Occur
Cerulean Warbler	*Dendroica cerulean*	200,000	Mixed mesophytic and Appalachian oak forests	Horizontal limb of a deciduous tree in mid- to upper-canopy	Fragmentation and elimination of habitat	1,2,3,4	Not Likely to Occur

Common Name	Scientific Name	WV Population Estimates	Habitat Type	Nesting Sites	Reason for Decline	Recon. Area	Tailwater Area
Worming-eating Warbler	*Helmitheros vermivorus*	80,000	Areas where deciduous and mixed forests overlap with patches of dense understory shrubs	Ground	Dependence on large forests for nesting make it vulnerable to population decreases	1,2,3,4	Not Likely to Occur
Swainson's Warbler	*Limnothlypis swainsonii*	3,000	Associated with swamps, rivers, floodplain forests and bottomland hardwood forests	Build a bulky cup nest a meter or two from the ground in dense understory	Extreme habitat specificity puts species at risk from habitat loss	1,2,3,4	Not Likely to Occur
Louisiana Waterthrush	*Parkesia motacilla*	40,000	Along streams flowing through valleys of heavily wooded deciduous forests	Cavities on stream banks, under fallen logs, or within roots of an upturned tree.		1,2,3,4	Not Likely to Occur
Kentucky Warbler	*Oporornis formosus*	100,000	Dense understory of mature humid deciduous and Northern	Ground	Sensitive to habitat fragmentation and cowbird parasitism	1,2,3,4	Not Likely to Occur

Common Name	Scientific Name	WV Population Estimates	Habitat Type	Nesting Sites	Reason for Decline	Recon. Area	Tailwater Area
			hardwood forests				
Canada Warbler	*Wilsonia canadensis*	20,000	Mixed coniferous and deciduous trees with a dense understory	Ground		1,2,3,4	Not Likely to Occur
Bald Eagle	*Haliaeetus leucocephalus*		Near estuaries, lakes, rivers and reservoirs	Tall trees or structures	Hunters, collisions with motor vehicles and stationary structures, and destruction of shoreline nesting, perching, roosting and foraging habitats	1,2	Likely to Occur
Peregrine Falcon	*Falco peregrinus*		Along mountain ranges, river valleys and coastlines	Cliffs or manmade structures		1,2,3	Likely to Occur
Yellow-bellied Sapsucker	*Sphyrapicus varius*	300	Mixed hardwood forests, woodlots and orchards	Cavities			Not Likely to Occur

Sources: Partners in Flight Science Committee 2013, Cink 2002, Buckelew 1994, WVDNR 2005, Roth et. al. 1996, Confer 1992, Nolan 1999, Hamel 2000, Hanners 1998, Brown and Dixon 1994, Conway 1999, Bueler 2000, White et. al. 2002, Walters et. al. 2002.

In addition to these three petitioned species, 67 additional rare species of amphibian, reptile, bird, and mammal tracked by the WV Department of Natural Resources are known or suspected to occur within the project area. These species are listed in Appendix C, along with their presumed occurrence locations and typical habitat.

4.3 Aquatic Resources

This section characterizes the aquatic resources found within the study area, with an emphasis on the portion of the study area between Bluff City, VA and Gauley Bridge, WV, particularly the tailwater area just downstream of the dam. Federal and state listed threatened and endangered species and state imperiled species are also identified.

4.3.1 Investigative Methods and Resources

The 1998 DSAS FEIS provided a thorough overview of the New-Kanawha river system and the substrates found in portions of the system within the project area. This overview is summarized and supplemented with information provided by the USFWS and gathered from a review of relevant literature.

4.3.2 Inventory of Aquatic Resources

4.3.2.1 Description of Aquatic Resources

The New River, the largest northerly flowing river in the United States, originates near Blowing Rock, NC and joins the Gauley River near Gauley Bridge, WV to form the Kanawha River. The Kanawha River feeds into the Ohio River at Point Pleasant, WV. Draining a watershed of 17,918 square kilometers (Stauffer 1995), the New River is characterized by a swift flow due to its narrow floodplain and steep gradient in some reaches, which maintains its relatively low silt content. The low sedimentation rates in this region provide good habitat for aquatic insects (EMAP 2000), which in turn provide food for other aquatic species. The average drop of the river is approximately three to five feet per mile, and monthly mean flow between 1927 and 2003 ranged from approximately 2,900 cfs in the fall to 8,200 cfs in the spring (NPS 2009a). The major tributaries of the New River, aside from the Gauley River, are the Bluestone and Greenbrier Rivers (Stauffer 1995). The Greenbrier enters the New River just downstream of Bluestone Dam and Bellepoint, WV. The Bluestone River originates near Springville, VA and converges with the New River 2.5 miles upstream from the dam. The average gradient of the Bluestone River over its course is 27 feet per mile (Purvis 2002). The dam creates Bluestone Lake, the boundaries of which are variable depending on the pool elevation at any given time, ranging from 10.5 miles upstream of the dam when the pool elevation is at 1,410 (summer pool) and 36 miles upstream when the pool elevation is at 1,520 (maximum flood control elevation).

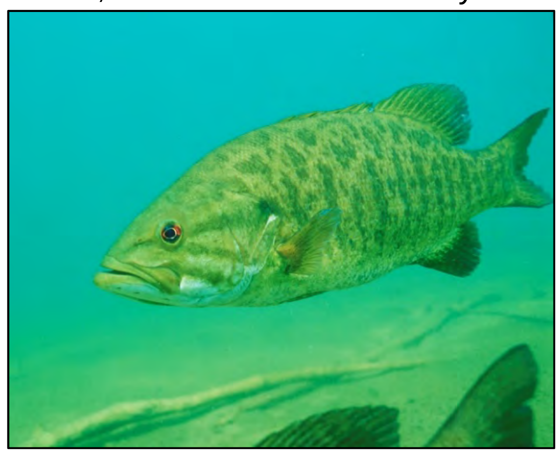
The New River supports a diverse and productive macrophyte community (Hill *et al.* 1984). The New River upstream of Bluestone Lake is considered an important spawning, rearing, adult, and migration habitat for multiple game species of fish due to its size and geomorphologic variety, including ledge drops, pools, runs, side eddies, islands, backwaters, large woody debris, bank overhangs, forested bank cover, and substrates suitable for spawning (NPS 2009a). Bluestone Lake is within the New River Gorge National River (NERI), which as a whole is recognized as supporting a diverse range of fish and other aquatic species (Mahan 2004). Hydraulic retention time in the lake is estimated to be six days, which is relatively short and reduces the risk of anaerobic conditions (Tillman *et al.* 1994). Indian Creek, which is a tributary of Bluestone River above Bluestone Lake, has a substrate consisting of bedrock, large rubble, cobbles, sand and silt with substantial riparian vegetation. The Bluestone River substrate consists of large and small rubble, sand and silt and has historically shown a high abundance of fish and benthic organisms despite its lack of instream habitat diversity. The overall condition of benthic communities within the New River Gorge and Gauley River is considered better than the Southern Appalachian region as a whole (Tzilkowski *et al.* 2010).

Tailwater Area of Bluestone Dam

The tailwater area of the New River, just downstream of the dam, is considered by USFWS as a Resource Category 1 habitat, which is defined under USFWS (Mitigation Policy 501 FW 2) as "high value for evaluation species and is unique and irreplaceable on a national basis or in the ecoregion section." The tailwater area is a riffle-run area with a gravel, cobble and boulder substrate. At the time that a Habitat Evaluation Procedure (HEP) analysis was conducted in the summer of 2013, pool areas existed on the left descending side of the river in the vicinity of the in-stream island that exists approximately 1,000 feet downstream of the dam baffles. Water levels were high at the time of the analysis, which could have made the pool habitat more difficult to recognize. The availability of pool habitat increases downstream, past Bellepoint, WV. The HEP analysis report is provided in Appendix D.

Water star-grass (*Heteranthera dubia*), pondweed (*Potamogeton spp.*) and Nuttall waterweed (*Elodea spp.*) are common aquatic plants found within the New River, and are often associated with mussel beds (Mahan 2004). Mussels, crayfish and other macroinvertebrates are a critical piece of the riverine ecosystem. While mussel abundance is high in the New River Gorge National River portion of the study area, mussel species diversity is low (NPS 2009a). Species identified in previous studies in the New River Gorge include pocketbook mussel (*L. ovata ventricosa*), wavy-rayed lampmussel (*Lampsilis fasciola*), elktoe mussel (*Alasmidonta marginata*), green floater (*Lasmigona subviridis),* mucket pearly mussel (*Actinonaias carinata,* pistolgrip mussel (*Tritpgonia verrucosa*), maple leaf mussel (*Quadrula quadrula),* purple wartyback mussel (*Cyclonaias tuberculata*), and spike mussel (*Elliptio dilatata*) (Mahan 2004; Jirka 1987). A 2002 survey identified only two mussel species in the tailwater area of the dam: pistolgrip and purple wartyback (USACE 2011).

The exotic Asiatic clam (*Corbicula fluminea*) has become abundant in the New River, and invasive zebra mussels (*Dreissena polymorpha*) are well established in the Kanawha River upstream of the Kanawha Falls, which could eventually be introduced to the New River (USFWS 2014). Just downstream of Kanawha Falls, the Kanawha River has abundant and diverse mussel beds containing at least 36 species of mussel; however, the lower 75 miles of the Kanawha have both low mussel diversity and abundance.



Smallmouth bass. Photo courtey of USFWS

Crayfish are an important food source for not only fish and aquatic salamanders, but also for certain birds, mammals, and reptiles. Because crayfish are typical prey for sport fish species such as smallmouth bass (*Micropterus dolomieui*), crayfish are also harvested for bait from the New River (Roell and Orth 1992). Crayfish species identified in the New River by various studies include Teays River Crayfish (*Cambarus sciotensis*), Sanborn's crayfish (*Orconected sanbornii sanbornii*), Spiny stream crayfish (*Orconectes cristavarius*), Allegheny Crayfish (*Orconectes obscurus*), Appalachian Brook Crayfish (*Cambarus bartonii cavatus*), rock crayfish (*Cambarus carinirostris*), big water crayfish (*Cambarus robustus*), and New River crayfish (*Cambarus chasmodactylus*). Virile crayfish (*Orconectes virilis*), a non-native species, has disrupted the species assemblage in the New River (Swecker 2012).

Aquatic invertebrate abundance in the New River is highest directly below Bluestone Dam and decreases downstream (USFWS 2014), which may be due in part to the eutrophic nature of Bluestone Lake and high plankton concentration (USACE 2016d). Within the New River Gorge, NPS monitoring has shown that the most abundant aquatic invertebrate families below the dam are Net-spinning caddisflies (*Hydropsychidae*) and midges (*Chironomidae*). Other families found in the New River

Gorge include *Megaloptera*, Mayfly (*Oligoneuriidae, Baetidae, Ephemerallidae*), riffle beatles (*Elmidae*), and gill breathing snails (*Pleuroceridae*) (Purvis *et al.* 2002).

Channel catfish. Photo courtesy of USFWS

While discrepancies in the exact number of fish taxa found within the New River Gorge National River and Bluestone River exist within scientific literature, all studies indicate that these Rivers comprise a valuable warmwater fishery with a high proportion of endemic native species (Mahan 2004). The most common species within the New River are bigmouth chub (*Nocomis platyrhynchus*), spotfin shiner (*Cyprinella spiloptera*), silver shiner (*Notropis photogenis*), mimic shiner (*Notropis volucellus*), bluntnose minnow (*Pimephales notatus*), channel catfish (*Ictalurus punctatus*), flathead catfish (*Pylodictis livaris*), and smallmouth bass (*Micropterus dolomieu*) (Mahan 2004). Kanawha Falls, approximately two miles below the confluence of the New and Gauley Rivers, serves as a natural barrier to upstream migration of fishes and has driven the unique nature of the fish assemblage upstream from Gauley Bridge (Purvis 2002). The Bluestone River has a similar native species assemblage to the New River, given its relative isolation from the rest of the Ohio River Basin. Different fish species occupy different microhabitats within the New River, and five habitat-use guilds have been identified for New River Gorge National River fish species. Table 4-4 provides examples of the species found in each of these guilds.

Table 4-4. Fish Guilds and Species Assemblage Examples

Habitat Use Guilds	Common Species in Each Guild
Edge-pool	bluntnose minnow, logperch (*Percina caprodes*), young-of-year (YOY) and juvenile northern hog sucker (*Moxostoma macrolepidotum*), small-sized white and striped shiners (*Luxilus albeolus, L. chrysocephalus*), white crappie (*Pomoxis annularis*), all sizes of spotted bass and sunfish (*Lepomis sp.*), and mimic, spottail, and spotfin shiner (*N. hudsonius,*)
Middle-pool	common carp (*Cyprinus carpio*), adult flathead catfish, channel catfish, and muskellunge (*Esox masquinongy*)
Riffle	adult bigmouth chub, rainbow and sharpnose darters (*Etheostoma caeruleum*, *Percina oxyrhynchus*), YOY flathead catfish, telescope shiner (*Notropis telescopus*), rosyface shiner (*N. rubellus*), and large white and striped shiners
Edge-channel	YOY smallmouth bass, greenside and Roanoke darters (*Etheostoma blennioides, Percina roanoka*), central stonerollers (*Campostoma anomalum*), and YOY bigmouth chub
Generalist	juvenile and adult smallmouth bass, and all sizes of rock bass

Source: Purvis *et al.* 2002.

Non-native fish pose a substantial threat to the unique native and endemic fish assemblage of the Bluestone and New Rivers, which make up nearly half of the fish population of the New River System (Jenkins and Burkhead 1994; Stottard 2006). The introduction of non-native fish and a general lack of large woody material necessary to maintain habitat complexity are considered common stressors to fish assemblages throughout the North-central Appalachians region (Stoddard 2006).

Rosyface shiner. Photo courtesy of Alan Dextrase, Fishbase

An electro-fishing survey conducted by the USACE in 2004 immediately downstream of the dam found equal numbers of native and non-native fish species (USACE 2004). Some of the native species identified were channel catfish, logperch, sharpnose darter, greenside darter, longnose dace (*Rhinichthys cataractae*), Northern hogsucker (*Hypentelium nigricans*), central stoneroller (*Campostoma anomalum*), rosyface shiner, spotfin shiner, white shiner, bigmouth chub, and flathead catfish, with the most abundant being rosyface shiner and bigmouth chub. Some of the nonnative species identified during the survey were rock bass (*Ambloplites rupestris*), bluegill (*Lepomis macrochirus*), smallmouth bass, spotted bass (*Micropterus punctulatus*), largemouth bass (*Micropterus salmoides*), white crappie, rainbow darter, brook silverside (*Labidesthes sicculus*), redbreast sunfish (*Lepomis auritus*), telescope shiner, margined madtom (*Noturus insignis*), and Roanoke darter, with smallmouth bass being the most abundant.

Fish populations south of the Gauley Bridge are not considered as healthy as those closer to Bluestone dam. Fish surveys within the Kanawha river by WVDNR have shown depressed fish abundance, although restoration efforts focused on this system since 2003 have led to limited recolonization of the system by sauger (*Sander canadensis*), walleye (*Sander vitreus*), paddlefish (*Polyodon spathula*), blue catfish (*Ictalurus furcatus*), and shovelnose sturgeon (*Scaphirhynchus platorynchus*) (USFWS 2014).

4.3.2.2 Federally-Listed Endangered and Threatened Species and Species of Concern and State-Listed Sensitive Aquatic Species

No Federally-listed endangered or threated aquatic species are known to occur upstream of Gauley Bridge in the project area. Five Federally-listed endangered mussels and one endangered fish, listed in Table 4-5, are either known or could potentially be found within the Kanawha River downstream of Gauley Bridge (USFWS 2014; USACE 2015).

Table 4-5. Federally-listed Endangered Aquatic Species in Project Area

Taxa	Common Name	Scientific Name
Invertebrate (mussel)	Fanshell	*Cyprogenia stegaria*
Invertebrate (mussel)	Pink mucket pearly mussel	*Lampsilis abrupta*
Invertebrate (mussel)	Sheepnose	*Plethobasus cyphyus*
Invertebrate (mussel)	Spectaclecase	*Cumberlandia monodonta*
Invertebrate (mussel)	Tuberculed blossom	*Epioblasma torulosa torulosa**
Fish	Diamond darter	*Crystallaria cincotta*

*may now be extinct (USFWS 2014).

While recovery efforts within the Kanawha River have shown expanding range and increasing number in some of these endangered mussel species, the range continues to be fairly limited to the five miles just downstream of Kanawha Falls. The diamond darter is found only within the Elk River, which is a tributary of the Kanawha River, downstream of Gauley Bridge.

USFWS has received petitions to list as endangered or threatened six species that occur or potentially occur between Bluff City, VA and Gauley Bridge, WV: Bluestone sculpin (*Cottus sp.*), Eastern hellbender (*Cryptobranchus alleganiensis*), candydarter (*Etheostoma osburni*), popeye shiner (*Notropis ariommus*), New River crayfish (*Cambarus chasmodactylus*), and green floater (*Lasmigona subviridis*) (USFWS 2014). Aside from these Federally-listed species and species petitioned for listing, the WV Natural Heritage Program tracks three rare fish, one rare crayfish, and 10 rare mussels that occur or could occur within the project area. None of the fish or crayfish are thought to occur upstream of Gauley Bridge. These species, and their known or suspected occurrences, are listed in Table 4-6.

Table 4-6. State Imperiled Aquatic Species of the Bluestone National Scenic River, New River Gorge National River, and the Gauley River National Recreation Area

Taxa Category	Common Name	Scientific Name	State Ranking	Global Ranking	Park Occurrences
Fish	Ohio lamprey	*Ichthyomyzon bdellium*	S2	G3G4	GR
Fish	Popeye shiner*	*Notropis ariommus*	S2	G3	GR
Fish	Northern madtom	*Noturus stigmosus*	S1	G3	GR
Crayfish	Elk River crayfish	*Cambarus elkensi*	S1	G2	GR
Mussel	Elk toe	*Alasmidonta marginata*	S2	G4	B, NR

Taxa Category	Common Name	Scientific Name	State Ranking	Global Ranking	Park Occurrences
Mussel	Purple wartyback	*Cyclonaias tuberculata*	S1	G5	B, NR
Mussel	Yellow lampmussel	*Lampsilis cariosa*	S1	G3G4	GR
Mussel	Wavy-rayed lampmussel	*Lampsilis fasciola*	S1	G3G4	B, NR
Mussel	Pocketbook	*Lampsilis ovata*	S1	G5	B, NR
Mussel	Green floater*	*Lasmigona subviridis*	S2	G3	B, GR
Mussel	mapleleaf	*Quadrula quadrula*	S2	G5	NR
Mussel	Lilliput	*Toxolasma parvus*	S2	G5	B, NR
Mussel	pistolgrip	*Tritogonia verrucosa*	S2	G4G5	B, NR
Mussel	Rainbow	*Villosa iris*	S2	G5	BR

*Petitioned for Federal listing as endangered or threatened.
State Rankings:
S1 – Critically imperiled – At very high risk of extirpation from the state due to extreme rarity (often 5 or fewer populations), very steep declines or other factors
S2 – Imperiled – At high risk of extirpation from the state due to very restricted range, very few populations (often 20 or fewer) steep declines, or other factors
S3—Vulnerable – At moderate risk of extirpation from the state due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors

Global Rankings:
G1 – Critically Imperiled – At very high risk of extinction due to extreme rarity (often 5 or fewer populations), very steep declines, or other factors
G2 – Imperiled – At high risk of extinction due to very restricted range, very few populations (often 20 or fewer) steep declines, or other factors
G3 – Vulnerable – At moderate risk of extinction due to a restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors
G4 – Apparently secure - Uncommon but not rare; some cause for long-term concern due to declines or other factors
G5 -- Secure – Common; widespread and abundant

Park Occurrences:
B--Bluestone National Scenic River
NR--New River Gorge National River
GR -- Gauley River National Recreation Area

4.4 Wetland Resources

In this section of the SDEIS, wetlands located in the study area are described. In addition, Federally-listed threatened and endangered species, species of concern, and State-listed sensitive species which are found in wetlands are identified.

4.4.1 Investigative Methods and Resources

A wetland delineation of the specific project area has not been conducted; therefore, existing wetland resources were determined by reviewing the USFWS National Wetland Inventory (NWI) maps, data contained in the original 1998 FEIS and information in the USFWS Fish & Wildlife Coordination Act Report.

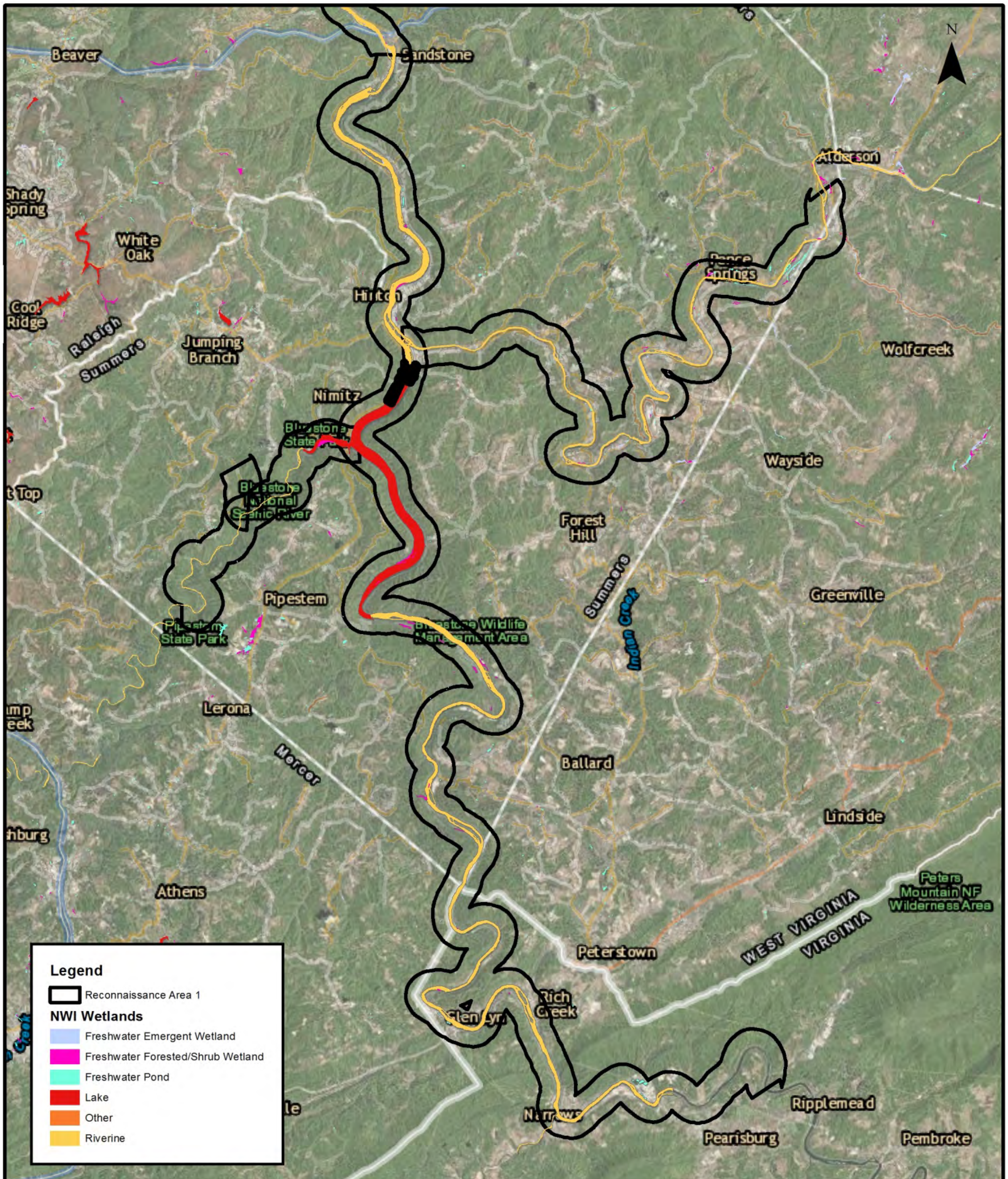
4.4.2 Inventory of Wetland Resources

4.4.2.1 Description of Wetland Resources

The SDEIS study area for wetlands has been defined as a one-half mile corridor along either side of the New River from Narrows, VA to Pt. Pleasant, WV, which correlates with the four reconnaissance areas utilized in the 1998 FEIS. This portion of the New River traverses through mountainous terrain of sandstone and shell bluffs and steep slopes. Wetlands within this area generally occur along the edges of the river/lake banks or on flats/islands within the floodplains. According to NWI maps, there are 899 acres of wetland habitat, 2.545 acres of open water in the form of lake or pond habitat, and 15,220 acres of riverine habitat within the defined study area (USFWS 2016a). Wetland acreages are only estimates from aerial photo interpretation. A past study by the NPS compared the data from NWI maps to an actual delineation along the New River from Hinton to the I-64 Bridge. Results showed a 35.5 percent increase of wetlands found during the wetland delineation over the data from the NWI maps. Therefore, actual wetland acreage within the corridor may be considerably greater than what is shown on the NWI maps.

According to NWI maps, wetlands occurring within the corridor include freshwater emergent wetlands, freshwater forested/shrub wetlands, and freshwater ponds. Figure 4-1 shows the location and types of wetlands within Reconnaissance Area 1. The USFWS Planning Aid Letter classified wetlands within Reconnaissance Areas 1 and 2 as temporarily flooded riverine wetlands on unconsolidated or rocky shores, permanently flooded riverine wetlands, and temporarily flooded, broad-leaved deciduous palustrine wetlands (USFWS 2014). In addition to these wetland types, the WV Department of Natural Resources (WVDNR) has identified two additional wetland types within the New River Forge National River, which provide valuable habitat to a variety of wildlife species. According to the WVDNR, there are 92 forest seeps and 28 beaver influenced wetlands within the New River Gorge National River.

A large bottomland forested wetland is located at Crumps Bottom and the mouth of Indian Creek in Bluestone Lake. This wetland habitat is predominantly palustrine forest with some emergent and scrub/shrub wetlands occurring throughout the area. Common tree species observed within these wetlands include box elder (*Acer negundo*), silver maple (*Acer saccharinum*), red maple (*Acer rubrum*), slippery elm (*Ulmus fulva*), black gum (*Nyssa sylvatica*), and river birch (*Betula nigra*). These wetlands and others occurring along the normal pool stage of the dam are adversely



WETLANDS WITHIN RECONNAISSANCE AREA 1

Bluestone Dam SEIS

ECS - GEC JV

Figure: 4-1

Date: June 2016

Scale:1:240,000

Source: ESRI/USFWS/GEC

Map ID:0027970110000-3178

impacted by siltation, while wetlands upstream of normal pool stage are in pristine condition (USFWS 2014).

Downstream of the dam in Reconnaissance Areas 3 and 4, NWI data categorize the wetland habitats as small areas of freshwater emergent wetlands and freshwater forested/shrub wetlands. Disturbances from moving vessels and other activities along the river have caused erosion of the riverbanks; silted in islands, embayments, and backchannels; and created open water pools where swamps, and former river meanders once occurred. Therefore, the wetland habitats are believed to be of low to moderate value in these areas.

4.4.2.2 Federally-Listed Endangered and Threatened Species and Species of Concern and State-Listed Sensitive Wetland Species

According to the USFWS Planning Aid Letter, Virginia spiraea (*Spiraea virginiana*) is the only Federally protected floral species occurring in wetland habitats within the project area and it only occurs in Reconnaissance Areas 1 and 2 of the study area. There are no known occurrences of this species within Reconnaissance Areas 3 and 4 nor do these areas contain suitable habitat for the species. Additionally, wetland habitats within the study area support many plant species that are listed by the states of Virginia and WV as species of concern or rare. While WV has no state threatened and endangered species legislation, Virginia does maintain a list of state threatened and endangered species that augments the Federal list (Appendix B).

One species on this list that has the potential to occur within the study area is the Tennessee pondweed (*Potamogeton tennesseensis*). This species is found in river shallows and streams.

4.5 Floodplain Resources

Executive Order 11988 requires federal agencies to avoid, to the extent possible, long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. 44 CFR Part 9 Floodplain Management and Protection of Wetlands provides Federal Emergency Management Administration (FEMA) policy, procedure, and responsibilities to implement and enforce Executive Order 11988.

This section identifies floodplains within the project area and discusses how the proposed activities would impact these floodplains.

4.5.1 Investigative Methods and Resources

Floodplains within the project area were identified using 2006 FEMA Flood Insurance Rate Maps (FIRMs), the WV Flood Tool (2015) and the Virginia Flood Risk Information System (FRIS) (2016).

4.5.2 Inventory of Floodplain Resources

Floodplains, which are areas in the valley floor adjacent to a channel which may be inundated during high water, extend along rivers and streams throughout the study area. Between Bluff City, VA and Sandstone, WV, floodplains within the study area are comprised of the valley floor along the New and Bluestone Rivers, as well as a portion of Bluestone Lake. Although Bluestone Lake does not have a FEMA mapped floodplain, areas between elevation 1,410 and 1,520 feet are dedicated for flood control, and are considered part of the floodplain. Seasonal pool elevations range between 1,406 feet in winter and 1,410 feet in summer, and pool elevations can reach up to 1,520 feet for flood control.

Along the New River, the floodplain is narrow and largely undeveloped. It includes recreation areas such as the lower portion of Bluestone State Park, part of the Bluestone Wildlife Management Area, and the upper portion of the New River Gorge National River. From Sandstone to Gauley Bridge, the floodplain is also limited to narrow river valleys between steep hillsides, largely within the New River Gorge National River. Downstream of Gauley Bridge, the floodplain becomes broader, and includes cities such as Montgomery, Alloy, Chelyan, Kanawha City, and Charleston. Several industrial sites also exist within the floodplain along this stretch of the river. Between Buffalo and Point Pleasant, WV, the floodplain is comprised primarily of agriculture and pasture.

Flooding within the Kanawha and New River Basins is caused primarily by unusual intensity or duration of precipitation, most frequently during the winter or early spring. Bluestone Dam is part of a larger flood control system for the entire Ohio River Basin, including the Kanawha and New Rivers. Flows through Bluestone Dam are regulated in concert with other dams within the system in order to maintain maximum flows or control points along the system. These maximum flows are intended to minimize flood damage in communities within the floodplain. However, the control points can be exceeded during major floods, and communities and development within the floodplain remain vulnerable to flooding. Bluestone Dam has reduced flood peaks downstream by at least 50 percent (NPS 2011a), but does not completely eliminate flood risk in the downstream floodplain, in part because the Greenbrier River feeds into the New River below Bluestone Dam and thus is not controlled by the dam.

Floodplains are flooded at different occurrence intervals, or different estimates of likelihood of inundation. As part of its management of the National Flood Insurance Program (NFIP), FEMA develops maps and flood hazard data for flood-prone communities throughout the country. The FIRMs identify Special Flood Hazard Areas

(SFHAs). A SFHA is defined as an area that will be inundated by a flood event having a 1-percent chance of being equaled or exceeded in any given year. A flood event with this probability is also referred to as the “base flood” or “100-year flood”; thus, these SFHAs are also referred to as “base floodplains” or “100-year floodplains.” The 100-year floodplains in the project area, as defined by FEMA, are shown on maps in Appendix E.

Based on data from the WV Flood Tool (2015) and FRIS (2016), 100-year floodplains lie mostly within undeveloped areas or agricultural lands within the study area, as well as small portions of developed land in the following cities and communities:

- Hinton, WV
- Meadow Creek, WV
- Thayer, WV
- KM Junction, WV
- Deep Water, WV
- Kimberly, WV
- Handley, WV
- Pratt, WV
- Handsford, WV
- Glasgow, WV
- Cedar Grove, WV
- East Bank, WV
- Diamond, WV
- Chesapeake, WV
- Belle, WV
- Chelyan, WV
- Marmet, WV
- Lower Belle, WV
- Dupont City, WV
- Malden, WV
- Kanawha City, WV
- South Ruffner, WV
- Charleston, WV
- Spring Hill, WV
- Dunbar, WV
- Nitro, WV
- Bancroft, WV
- Hometown, WV
- Winfield, WV
- Eleanor, WV
- Midway, WV
- Frasiers Bottom, WV
- Buffalo, WV
- Pliny, WV
- Robertsburg, WV
- Leon, WV
- Ambrosia, WV
- Henderson and WV
- Point Pleasant, WV
- Narrows, VA
- Rich Creek, VA
- Glen Lyn, VA

4.6 Water Resources

In this section of the SDEIS, water quality throughout the impact area is identified for both surface waters and groundwater.

4.6.1 Investigative Methods and Resources

West Virginia Department of Environmental Protection (WVDEP), Virginia Department of Environmental Quality (VDEQ) and USGS databases and reports were utilized to compile the most recent water quality statistics for water resources within the project area.

4.6.2 Inventory of Water Resources

4.6.2.1 Surface Waters

Primary surface waters in the study area are comprised of the New River, Bluestone Lake, and the Kanawha River. Reconnaissance Area 1 includes the mainstem of the New River from Bluff City, VA to Sandstone, WV, including Bluestone Lake. Two of the major tributaries of the New River upstream of Bluestone Lake are Indian Creek and Bluestone River. Reconnaissance Area 2 includes the New River from Sandstone to Gauley Bridge. Reconnaissance Areas 3 and 4 are dominated by the Kanawha River, with Reconnaissance Area 3 between Gauley Bridge and Poca, WV, and Reconnaissance Area 4 from Poca to Point Pleasant, where the Kanawha River feeds into the Ohio River.

Bluestone Lake is an artificial lake created by the Bluestone Dam on the New River near Hinton, WV. The lake is subject to frequent level fluctuation due to the large drainage area it contains and from peaking flows from hydroelectric power generation at Claytor Lake, in Virginia. Segments of river systems within the study area have been designated as part of the Wild and Scenic Rivers System. A 13-mile segment of the Bluestone National Scenic River stretches from Pipestem Resort State Park to the limits of Bluestone Lake’s summer pool. Between Hinton and Hawks Nest State Park near Ansted, WV, the New River has been designated as a National River. This segment is known as the New River Gorge National River.

Surface water quality standards are the legal controls by which Clean Water Act (CWA) mandated water quality control is enforced, and are intended to help protect and maintain water quality necessary to meet and maintain designated or assigned uses, such as swimming, recreation, public water supply, and/or aquatic life. The WVDEP and VDEQ are state agencies responsible for enforcement of these standards in their respective states. In WV, these water quality standards are found in 47CRS2*, Requirements Governing Water Quality Standards* (effective June 21, 2014). In Virginia, these water quality standards are found in 9 VAC 25-260, *Water Quality Standards*.

In both states, these standards consist of established uses of each waterbody, water quality criteria intended to protect these designated uses, and an anti-degredation policy intended to maintain and protect existing uses and high quality water bodies and reaches. Designated uses in Virginia include: recreational uses (e.g., swimming and boating); the propagation and growth of a balanced, indigenous population of aquatic life, including game fish, which might reasonably be expected to inhabit them; wildlife; and the production of edible and marketable natural resources (e.g., fish and shellfish). Designated uses in WV are provided in Table 4-7.

Table 4-7. Designated Uses of Waterbodies under West Virginia Water Quality Standards

Category	Use Category	Use Subcategory	Description
A	Human health	Public water	Waters, which, after conventional treatment, are used for human consumption.
B1	Aquatic life	Warm water fishery	Propagation and maintenance of fish and other aquatic life in streams or stream segments that contain populations composed of all warm water aquatic life.
B2		Trout waters	Propagation and maintenance of fish and other aquatic life in streams or stream segments that sustain year-round trout populations. Excluded are those streams or stream segments which receive annual stockings of trout but which do not support year-round trout populations.
B4		Wetlands	Propagation and maintenance of fish and other aquatic life in wetlands. Wetlands generally include swamps, marshes, bogs and similar areas.
C	Human health	Water contact recreation	Swimming, fishing, water skiing and certain types of pleasure boating such as sailing in very small craft and outboard motor boats.
D1	All others	Irrigation	All stream segments used for irrigation.
D2		Livestock watering	All stream segments used for livestock.
D3		Wildlife	All stream segments and wetlands used for wildlife.

Category	Use Category	Use Subcategory	Description
E1		Water transport	All stream segments modified for water transport and having permanently maintained navigation aids.
E2		Cooling water	All stream segments having one or more users for industrial cooling.
E3		Power production	All stream segments extending from a point 500 feet upstream from the intake to a point one-half mile below the wastewater discharge point.
E4		Industrial	All stream segments with one or more industrial users. It does not include water for cooling.

Source: WVDEP 2014.

The Federal CWA, as well as WV and Virginia codes, require a comprehensive biennial report of water quality within each state. These reports, produced separately by each state, document whether each waterbody within the state supports its designated use or uses. For those waterbodies which do not fully support one or more of their designated uses, the reports note the contaminants exceeding applicable standards. Table 4-8 provides the water quality status of the portions of the New River and Kanawha River, including Bluestone Lake, that fall within the project area. Water quality status is not provided for tributaries of these main reaches, as surface water quality within the tributaries are not expected to be impacted by the actions described in this SDEIS.

Table 4-8. Water Quality Status of New and Kanawha River Within Project Area

Surface Water Body	Designated Use	Use Support	Water Pollutants
Lower New River: WV/VA State Line to Narrows, VA	Aquatic Life, Wildlife	Fully Supporting	n/a
	Fish Consumption, Recreation	Not Supporting	E. coli; (polychlorinated biphenyls (PCBs) in fish tissue
Bluestone Lake	Warm Water Fishery, Public Water Supply, Water Contact Recreation,	Insufficient Data	n/a

Surface Water Body	Designated Use	Use Support	Water Pollutants
	Agriculture and Wildlife, Industrial Water Supply		
Lower New River: Bluestone Dam to Gauley Bridge	Warm Water Fishery, Agriculture and Wildlife, Industrial Water Supply	Fully Supporting	n/a
	Public Water Supply, Water Contact Recreation	Not Supporting	Fecal coliform
Upper Kanawha: Gauley Bridge to Charleston	Warm Water Fishery, Public Water Supply, Water Contact Recreation, Agriculture and Wildlife, Industrial Water Supply	Fully Supporting	n/a
Lower Kanawha: Charleston to Point Pleasant	Warm Water Fishery	Insufficient Data	n/a
	Public Water Supply, Water Contact Recreation, Agriculture and Wildlife, Industrial Water Supply	Not Supporting	Fecal coliform

n/a = not applicable.
Sources: WVDEP 2014, VDEQ 2014.

Unlike other Appalachian waterways which are impaired by acid mine runoff, the Kanawha-New River area is not as heavily impacted by this type of run-off for two reasons. First, the coal of this area is low in sulfur, making it less acidic than higher-sulfur coal. Second, limestone in the surrounding area neutralizes the limited acidity of area mine run-off (NPS 2009b). According to Purvis *et al.* (2002) and reflected in the 2014 Integrated Water Quality Report information in Table 4-8, the most pervasive water resource issue for the New River within the New River Gorge National River is fecal coliform bacteria contamination. This contamination appears to stem from improper treatment and disposal of domestic sewage along tributaries of the New River. Other sources of fecal coliform can include sanitary sewer overflow and livestock grazing (Wilson and Purvis 2003).

Aside from the above impairments, the New River Gorge is also known to be impacted by trace metals (antimony, cadmium, lead, mercury and thallium) and trace chemical elements (arsenic, beryllium, chromium, copper, cyanide, fluoride, nickel, silver, sulfate, and zinc), which could harm aquatic life (Paybins *et al.* 2000; Purvis *et al.* 2002), though not at levels high enough to impair the waterway's designated uses. In general, the Kanawha-New River basin's surface waters are relatively low in nutrients, such as phosphorus and nitrogen, and pesticides. However, 2,3,7,8-tetrachlorodibenzo-p-dioxin (dioxin) is a known contaminant in the lower Kanawha River sediments, particularly between St. Albans and Winfield, likely due to former herbicide manufacturing activities which used the chemical (Paybins *et al.* 2000; USEPA 2004).

4.6.2.2 Groundwater

The majority of the project area lies within the Appalachian Plateaus physiographic province, with a small portion of the area lying within the Valley and Ridge province, primarily in Virginia. Groundwater in the study area is primarily found in alluvial deposits and sedimentary bedrock. Major alluvial deposits are located along the Kanawha River. Consolidated bedrock aquifers in the area include Pennsylvanian, Mississippian and Ordovicia aquifers, corresponding to the geographic age of the bedrock in which the aquifers are found. The Pennsylvanian aquifers are nearly horizontal sandstone with shale, siltstone, coal, and limestone. The Mississippian aquifers are moderately folded beds made primarily of sandstone and limestone with shale. The Ordovician aquifers consist of highly folded beds of limestone, shale, and sandstone (Kozar and Brown 1995).

The contaminants found in the study area's groundwater are strongly related to the area's geology. For example, iron is elevated in Pennsylvanian bedrock aquifers, as iron is produced through the oxidation of pyrite, which is common in coal-bearing bedrock. However, anthropogenic influences are also seen, including the presence of fecal indicator bacterial such as E. coli and fecal coliform in some locations (Chambers *et al.* 2012).

Approximately 42 percent of all West Virginians rely on groundwater for their domestic water supply (Chambers *et al.* 2012). As such, the USGS WV Water Science Center sampled 300 groundwater wells, of which 80 percent were public-supply wells, over a 10-year period (1999–2008) to assess the state's groundwater quality. The resulting 300 samples were supplemented with data from a related monitoring network of 24 wells and springs, several of which are located in within the counties of the study area.

The U.S. Environmental Protection Agency (USEPA) has established Federal Drinking Water Standards under the Safe Drinking Water Act (SDWA). There are two categories of these drinking water standards: National primary drinking water regulations, or primary standards, which protect drinking water quality by limiting the levels of specific contaminants that can adversely affect public health and are known or anticipated to occur in water from public water systems; and secondary drinking water regulations, or secondary standards, which guard against cosmetic or aesthetic impacts, such as stained teeth or undesirable odor (USEPA 2016).

Table 4-9 provides an overview of groundwater samples exceeding the USEPA primary or secondary standards for drinking water within project area counties in WV. Similar data for Giles County, VA was not available.

Table 4-9. Study Area Counties with Groundwater Samples Exceeding USEPA Primary or Secondary Maximum Contaminant Levels in West Virginia

Water Quality Issue	County Containing Sample Site with Issue	USEPA Maximum Contaminant Level
Fecal Coliform	Fayette, Mason	> 0 colony-forming units/100 ml
E. coli	Fayette	> 0 colony-forming units/100 ml
Arsenic (<10 micrograms/liter)	Summers, Fayette, Kanawha, Putnam, Mason	>10 micrograms/liter
Aluminum	Fayette, Kanawha*, Mason*	>50 micrograms/liter*; 200 micrograms/liter
Iron	Summers*, Fayette*, Kanawha*, Putnam*, Mason*	>300 micrograms/liter*
Manganese	Summers, Fayette, Kanawha, Putnam*, Mason	>50 micrograms/liter*; >300 micrograms/liter
Radon-222	Fayette, Putnam, Mason	>300 picocuries/liter

*Secondary standard.
Source: Chambers *et al.* 2012.

4.6.2.3 Erosion/Sedimentation

Natural erosion by water, wind, and other natural processes normally occurs at a slow rate, but can be accelerated during flooding. Anthropogenic land disturbance such as forestry, roads, agriculture, and stormwater runoff can accelerate erosion, leading to increased sediment loads in waterbodies (WVDEP 2008). For example, sediment yields within the Kanawha basin have been shown to vary greatly depending on surrounding land use; whereas forest lands and grasslands have been shown to yield 24 to 240 tons/sq.mi./year, and harvested forests lands, surface mining, and road construction have been shown to yield 12,000 to 66,000 tons/sq.mi./year (NPS 1996).

Erosion by water is classified in terms of increasing magnitude. Sheet erosion results primarily from rainfall impact and is relatively uniform over the surface, causing the least transport of soil particles. Rill erosion occurs where runoff has concentrated and gained enough force to detach soil particles. Continued erosion generates gullies and channels on slopes. The principal factors affecting the rate of erosion are the rate of runoff, geotechnical properties of the soil, slope, and type and amount of surface cover (vegetation). The rate of runoff is a function of rainfall intensity, the soil infiltration rate, and the size and nature of the upstream drainage area. Runoff occurs only after the rainfall intensity exceeds the infiltration rate. The infiltration rate depends on the soil porosity, moisture content, organic matter and the vegetative cover.

Sedimentation is the final step in the erosion process. Deposition of waterborne sediment particles occurs when the flow velocity is reduced, and sediment particles settle out of the water column. Sediment may settle into pools and eddies along the stream where the velocity is low, smothering the aquatic organisms and covering fish spawning beds. Excess sediment is a known biological stressor in numerous streams within the New River watershed (WVDEP 2008). Sediments may also carry constituents into the water column, such as metals, that further impair waterbodies and enter the food chain of aquatic organisms (Mahan 2004). For example, portions of the New River in Virginia have been under a Virginia Department of Health fish-consumption advisory since 2001 due to PCBs in fish tissue samples (VDH 2016), as bottom-feeding organisms can ingest sediments contaminated with PCBs.

Sedimentation is a regular occurrence within Bluestone Lake. The reservoir has a higher capacity inflow ratio, and during floods, less water is discharged out of the sluice gates thn flows into the lake. As a result, most of the inflowing sediment is retained as water pools and slows upstream of the dam. The coarsest sediments settle out first, forming a backwater deposit. As flow velocity continues to decrease, sand and gravel settle out, forming a sand-gravel delta. This process continues until flow velocity has been sufficiently reduced so that clay and silt particles settle out to create a bottom cover in the reservoir. During floods and summer months when the pool is lowered, the sediments which have been deposited in the upper reaches of the reservoir are subject to erosion, and are transported farther into the reservoir. The cumulative sediment total from 1949 to 2007 was 12,019 acre-feet and the average annual rate of sedimentation was 208 acre-feet per year and 276 acre-feet per year for the last six years; however, this sedimentation has not had an impact on the flood control pool.

4.7 Air Quality Resources

This section of the SDEIS addresses air quality, including a review of area climatology, regulatory setting, and greenhouse gases and climate change. This resource is considered institutionally significant because of the WV Air Pollution Control Act and the Clean Air Act (CAA) of 1963, as amended. Air quality is technically significant because of the status of regional ambient air quality in relation to national ambient air quality standards (NAAQS). It is publicly significant because of health concerns and the desire for clean air expressed by all citizens.

Air quality issues will only be addressed for Reconnaissance Area 1 near the construction area, since this is the only area that could be affected by the construction activities as the vast majority of pollutants generated by construction have short travel distances. Operation of the dam generates no pollutants and, therefore, has no impact on air quality issues. Climate change is addressed for the entire study area.

4.7.1 Investigative Methods and Resources

The air quality analysis in the study area included a review of existing literature and databases. Data sources for this section were taken from historical climatological information, as well as from information gathered from the WVDEP Office of Air Quality and the National Oceanic and Atmospheric Administration (NOAA).

4.7.2 Inventory of Air Quality Resources

4.7.2.1 Climate

The project's mid-latitude position combined with the seasonal undulations of the northern jet stream makes this region susceptible to highly variable weather throughout the year. The watershed's climate is greatly influenced by oceanic (Gulf of Mexico moisture) and atmospheric (Canadian air mass) interactions. Rhythmic fluctuations in *El Niño* and *La Niña* Pacific currents combined with variable North Atlantic Oscillation patterns also affect seasonal weather in the project region (USACE 2016b).

Reconnaissance Area 1 lies within the region known as the Appalachian Mountain Climate Regime. The Appalachian Mountain region of the study area has sharp temperature contrasts, both seasonal and day-to-day. The average annual temperature near the study area is 54^{o} F, with monthly means ranging from 24^{o}F in January to 84^{o}F in July (US Climate Data 2016). The months of September through May are moderately cold, with fairly rapid seasonal temperature changes in April and October. Cold waves typically occur two or three times during the winter, but severe cold spells are seldom more than two or three days long. Cool nights are common throughout the summer, with the lowest temperatures usually ranging from the 50s to the low 60s; lows in the 30s during the same months have occurred. Summer highs near 90^{o}F have occurred, though highs seldom reach above the mid-80s. Average annual precipitation near the study area is 40 inches (NOAA 2016). Precipitation is well-distributed throughout the year, with lowest precipitation occurring in late fall/early winter months.

4.7.2.2 Air Quality

- <u>Regulatory Setting</u>
  The enactment of the CAA of 1970 resulted in the NAAQS and state implementation plans (SIPs). The USEPA established NAAQS for specific pollutants to determine the maximum levels of background pollution that are considered safe, with an adequate margin of safety, to protect public health and welfare. The NAAQS standards are classified as either "primary" or "secondary" standards. The major pollutants of concern, or criteria pollutants, are carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), particulate matter less than 2.5 microns

(PM-2.5) and less than 10 microns (PM-10), and lead (Pb). The NAAQS are included in Table 4-10.

Table 4-10. National Ambient Air Quality Standards

Pollutant	Primary Standards		Secondary Standards	
	Level	Averaging Time	Level	Averaging Times
CO	9 ppm	8-hour (1)	None	
	35 ppm	1-hour (1)		
Pb	0.15 µg/m³ (2)	Rolling 3-Month Average	Same as Primary	
NO_2	53 ppb (3)	1-year Annual Mean (Arithmetic Average)	Same as Primary	
	100 ppb	1-hour (4)	None	
PM-10	150 µg /m³	24-hour (5)	Same as Primary	
PM-2.5	12.0 µg /m³	1-year Annual Mean(6) (Arithmetic Average)	15.0 µg /m³	1-year Annual Mean(6) (Arithmetic Average)
	35 µg /m³	24-hour (7)	Same as Primary	
O_3	0.070 ppm	8-hour (8)	Same as Primary	
SO_2	75 ppb (9)	1-hour	0.5 ppm	3-hour (1)

Source: USEPA 2016a.Units of measure for the standards are parts per million (ppm) by volume, parts per billion (ppb - 1 part in 1,000,000,000) by volume, milligrams per cubic meter of air (mg/m3), and micrograms per cubic meter of air (µg/m3).

(1) Not to be exceeded more than once per year.

(2) In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, and for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m3 as a calendar quarter average) also remain in effect. Final rule signed October 15, 2008.

(3) The official level of the annual NO_2 standard is 0.053 ppm, equal to 53 ppb, which is shown here for the purpose of clearer comparison to the 1-hour standard.

(4) To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb (effective January 22, 2010).

(5) Not to be exceeded more than once per year on average over 3 years.

(6) To attain this standard, the 3-year average of the weighted annual mean PM-2.5 concentrations from single or multiple community-oriented monitors must not exceed 12.0 µg/m³ for primary standards and 15.0 µg/m³ for secondary standards.

(7) To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 µg/m³ (effective December 17, 2006).

(8) (a)To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.070 ppm.
(b) Final rule signed October 1, 2015, and effective December 28, 2015. The previous (2008) O_3 standards additionally remain in effect in some areas (0.075 ppm 8-hour). Revocation of the previous (2008) O_3 standards and transitioning to the current (2015) standards will be addressed in the implementation rule for the current standards.
(c) USEPA revoked the 1-hour ozone standard of 0.12 ppm in all areas, although some areas have continuing

obligations under that standard ("anti-backsliding"). The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is < 1.

(9) (a) Final rule signed June 2, 2010. To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.
(b) The previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will additionally remain in effect in certain areas: (1) any area for which it is not yet 1 year since the effective date of designation under the current (2010) standards, and (2) any area for which implementation plans providing for attainment of the current (2010) standard have not been submitted and approved and which is designated nonattainment under the previous SO_2 standards or is not meeting the requirements of a SIP call under the previous SO_2 standards (40 CFR 50.4(3)), A SIP call is a USEPA action requiring a state to resubmit all or part of its State Implementation Plan to demonstrate attainment of the required NAAQS.

Areas that meet both primary and secondary NAAQS standards are known as attainment areas. Areas that do not meet these NAAQS standards are called non-attainment areas. SIPs must be developed for these areas. The construction area for the Bluestone Dam modifications is located within Summers County, WV which is in attainment for all NAAQS (USEPA 2016b).

West Virginia maintains a statewide network of air quality monitoring stations which monitor air pollutants on either a continuous or periodic basis (WVDEP 2014a). The sampling sites are located to assess air quality levels based on population exposure, industry emissions, compliance with NAAQS, background levels, and other special purposes (WVDEP 2016). In the vicinity of the study area there are only two monitoring stations, located in Greenbrier County and Raleigh County. Criteria pollutants currently monitored in Raleigh County include PM-2.5; while only O_3 is monitored in Greenbrier County (WVDEP 2014b). According to the WVDEPs 2014 Air Quality Annual Report, the 3-year average (2011-2014) of the 8-hour standard for O_3 in Greenbrier County was 0.066 ppm. No data was given for Raleigh County.

- Conformity Determination
  The Federal Conformity Final Rule (40 CFR Parts 51 and 93) states that Federal actions must conform to Federal air quality regulations presented in the CAA. The rule mandates that a conformity analysis must be performed when a Federal action generates air pollutants in a region designated as non-attainment or maintenance area for one or more NAAQS.

  A conformity analysis determines whether a Federal action meets the requirements of the general conformity rule. It requires the responsible Federal agency to evaluate the nature of the Proposed Action and associated air pollutant emissions, calculate emissions as a result of the Proposed Action, and mitigate emissions if *de minimis* thresholds (100 tons per year) are exceeded. If the emissions exceed the *de minimis* thresholds, the proponent is required to conduct a conformity analysis and implement appropriate mitigation measures.

The construction area for the Bluestone Dam modifications is located within Summers County, WV which is in attainment for all NAAQS (USEPA 2016b). Therefore, the air emissions generated by the Proposed Action would not trigger a conformity determination even if they exceed *de minimis* levels.

4.7.2.3 Climate Change and Greenhouse Gases

The CEQ issued guidance to provide Federal agencies direction on when and how to consider the effects of climate change and greenhouse gas (GHG) emissions in their evaluation of all proposed Federal actions in accordance with NEPA. Federal agencies should consider the potential effects of a Proposed Action on climate change as indicated by its GHG emissions and should consider the implications of climate change for the environmental effects of a proposed action (CEQ 2014).

- <u>Climate Change</u>
  The information included in this Climate Change section is summarized from the Draft Bluestone Dam Safety Modification Study Future without Action Condition – Potential Future Effects of Climate Change in the Kanawha and New River Watershed (USACE 2016b), which is herein incorporated by reference. The synopsis is included in Appendix F.

  Global climate change refers to a change in the average weather on the earth. EO 13653 requires that Federal agencies describe any climate change related risks that may impair an agency's mission or operation, including through that agency's existing reporting requirements. The Bluestone DSMS and associated NEPA documents fall under that agency reporting requirement.

  Climate data has been accessed for several climate change studies of geographic areas that include the entire Kanawha and New River basins. The forecasted results from these studies provide a glimpse of what future with and without project climate conditions may prevail during a 50-year period of analysis during which an array of structural modifications and/or operational changes may be in effect at Bluestone Dam.

  The defined project area for addressing climate change effects consists of the area downstream of Bluestone Dam to the juncture of the Kanawha River and the Ohio River at Point Pleasant, WV and upstream from the dam through the boundary of the Federal lands acquired for the project and any flowage easements all the way to the farthest reaches of the New River Watershed in North Carolina. For the purposes of defining climate-induced changes to temperature, stream flow and rainfall intensity, the watershed of Bluestone Dam (4,565 m^2) extending into Virginia and North Carolina and the downstream New River/Kanawha River to the Kanawha River gage at Charleston is identified as the project area. This entire area has been modeled by several climate change studies.

- <u>Greenhouse Gases</u>
  GHGs are gases that trap heat in the atmosphere. Some GHGs occur naturally and are emitted to the atmosphere through natural processes and human activities, while other GHGs are created and emitted solely through human activities. These include water vapor, halons, ground level O_3, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), fluorinated gases including hydrochlorofluorocarbons (HFC) and perfluorcarbons (PFC), as well as sulfur hexafluoride (CEQ 2012).

  The major GHG-producing sectors in society include transportation, utilities (e.g., coal and gas power plants), industry/manufacturing, agriculture, and commercial/residential. End-use sector sources of GHG emissions include electricity generation (30 percent), transportation (26 percent), industry (21 percent), commercial and residential (12 percent), agriculture (9 percent), and land use and forestry (2 percent) (USEPA 2016d). The main sources of increased concentrations of GHG due to human activity include the combustion of fossil fuels and deforestation (contributing CO_2), livestock and rice farming, land use and wetland depletions, landfill emissions (contributing CH_4), refrigeration system and fire suppression system use and manufacturing (contributing CFC), and agricultural activities, including the use of fertilizers (USEPA 2016d).

- <u>Executive Order 13693</u>
  EO 13693, *Planning for Federal Sustainability in the Next Decade*, signed on March 15, 2015 revokes EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance,* and EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management,* in addition to other Presidential Memorandums which were the previous principal guidelines for GHG emissions. The goal of EO 13693 is to maintain Federal leadership in sustainability and GHG emission reductions. It identifies numerous energy goals in several areas, including GHG management, management of sustainable buildings and communities, and fleet and transportation management.

- GHG Reporting Program
  The USEPA GHG Reporting Program, formerly known as the GHG Mandatory Reporting Rule, requires reporting of GHG emissions from large sources and suppliers in the U.S., and is intended to collect accurate and timely emissions data to inform future policy decisions. The rule requires large suppliers of GHG emitting products, or facilities or activities that emit more than 25,000 metric tons (27,557 tons) CO_2 equivalent (CO_2e) per year to report their annual GHG emissions in the U.S., collect accurate and timely emissions data to inform future policy decisions, and submit annual GHG reports to the USEPA (USEPA 2016e). The GHGs of concern under EO 13693 are CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6. These GHGs have varying heat-trapping abilities and atmospheric lifetimes. Carbon dioxide equivalency (CO_2e) is a measuring methodology used to compare the heat trapping impact from various GHGs relative to CO_2. Some gases have a greater global warming potential than others. N_2O, for instance, has a global warming potential that is 310 times greater than an equivalent amount of CO_2, and CH_4 is 21 times greater than an equivalent amount of CO_2 (CEQ 2012).

- GHG Threshold of Significance
  The CEQ provided guidelines for determining meaningful GHG decision-making analysis (CEQ 2012). This guidance was affirmed as remaining in effect in the implementing instructions for EO 13693. The guidance serves as the Federal government's office GHG protocol, is used by Federal agencies to develop their GHG inventories, and establishes detailed information on inventory reporting requirements and calculation methodologies. The guidance states that if the Proposed Action would be reasonably anticipated to cause direct emissions of 27,557 tons or more of CO_2e GHG emissions on an annual basis, agencies should consider this an indicator that a quantitative and qualitative assessment may be meaningful to decision makers and the public. For long-term actions that have annual direct emissions of less than 27,557 tons of CO_2e, CEQ encourages Federal agencies to consider whether the action's long-term emissions should receive similar analysis. CEQ does not propose this as an indicator of a threshold of significant effects, but rather as an indicator of a minimum level of GHG emissions that may warrant some description in the appropriate NEPA analysis for agency actions involving direct emissions of GHGs (CEQ 2012).

4.8 Noise Quality Resources

This section addresses noise quality including characteristics of environmental noise and existing noise conditions within the project area. This resource is institutionally significant because of the Noise Control Act of 1972. Compliance with surface carrier noise emissions is technically significant. Exposure of persons to noise or generation of noise levels in excess of applicable standards is publicly significant due to health reasons and annoyance. The major sources of noise in general include transportation vehicles and equipment, machinery, appliances, and other products in commerce. The Congress declares that it is the policy of the United States to promote an environment for all Americans free from noise that jeopardizes their health or welfare. It is the purpose of the Noise Control Act to establish a means for effective coordination of Federal research and activities in noise control, to authorize the establishment of Federal noise emission standards for products distributed in commerce, and to provide information to the public respecting the noise emission and noise reduction characteristics of such products.

Noise quality issues are addressed only for Reconnaissance Area 1 near the construction area. This is the only area which can be affected by the construction or operational activities, as the noise produced within Reconnaissance Area 1 would not travel beyond the boundaries of that area. USACE does not have adopted noise standards and therefore uses local jurisdictional standards, if applicable.

4.8.1 Investigative Methods and Resources

Investigations conducted for preparation of this SDEIS consisted of a review of existing literature. Existing site-specific noise data for the concrete batch plant were measured by USACE contractors during Phase 3 construction.

4.8.2 Inventory of Noise Quality Resources

4.8.2.1 Characteristics of Environmental Noise

Noise is generally described as unwanted sound, which can be based either on objective effects (i.e., hearing loss, damage to structures, etc.) or subjective judgments (e.g., community annoyance). Environmental noise is the intensity, duration, and character of sounds from all sources. Sound is usually represented on a logarithmic scale with a unit called the decibel (dB). Sound on the decibel scale is referred to as sound level. The lower threshold of human hearing is approximately 0 dB, and the threshold of discomfort or pain is around 120 dB. The A-weighted decibel (dBA) is a measure of sound pressure adjusted (weighted) to conform to the frequency response of the human ear. The dBA metric is most commonly used for the measurement of environmental and industrial noise. Table 4-11 shows typical sound levels (dBA) for familiar sources.

Table 4-11. Typical Sound Levels (dBA) for Familiar Sources

Sound Pressure Level (dBA)	Typical Source	Subjective Evaluation
130 (Threshold of Pain)	Blasting	Extremely Noisy - Intolerable
120	Jet Take-Off (200 feet away)	
110	Rock Concert	
100	Pneumatic Hammer	Very Noisy
90	Boiler Room	
80	Busy Street Traffic	Loud
70	Classroom Chatter	
60	Conversation (3 feet away)	Moderate to Quiet
50	Urban Residence	
40	Soft Whisper (5 feet away)	Quiet to Very Quiet
30	Bedroom	
20	Silent Study Room	Almost Silent
<10 (Threshold of Hearing = 0 dBA)	Anechoic Chamber	Silent

Source: OSHA 2013.

Noise levels occurring at night generally produce a greater annoyance than do the same levels occurring during the day. It is generally agreed that people perceive intrusive noise at night as being 10 dBA (A-weighted decibel is a measure of noise at a given, maximum level or constant state level) louder than the same level of intrusive noise during the day, at least in terms of its potential for causing community annoyance. This perception is largely because background environmental sound levels at night in most areas are approximately 10 dBA lower than those during the day.

Acceptable noise levels have been established by the U.S. Department of Housing and Urban Development (HUD) for construction activities in residential areas:

Acceptable (not exceeding 65 dBA) – The noise exposure may be of some concern, but common building construction would make the indoor environment acceptable and the outdoor environment would be reasonably pleasant for recreation.

Normally Unacceptable (above 65 but not greater than 75 dBA) – The noise exposure is significantly more severe; barriers may be necessary between the site and prominent noise sources to make the outdoor environment acceptable; special building construction may be necessary to ensure that people indoors are sufficiently protected from outdoor noise.

Unacceptable (greater than 75 dBA) – The noise exposure at the site is so severe that the construction costs to make the indoor noise environment acceptable may be prohibitive and the outdoor environment would still be unacceptable (HUD 1984).

The sound level most commonly used for noise planning purposes is 65 dBA and represents a compromise between community impact and the need for activities like construction. USEPA identified 55 dBA as a level below which there is no adverse impact. At 55 dBA, 80 percent of the population finds sound tolerable, but 20 percent is annoyed. That level of sound is comparable to the family room in an occupied house; whereas, the kitchen during meal preparation is generally noisier (USEPA 1974).

- <u>Noise Attenuation</u>
  Point source noise is usually associated with a source that remains in one place for extended periods of time, such as with most construction activities. Noise from a single traveling vehicle is also considered a point source noise. As a general rule of thumb, noise generated by a stationary noise source, or point source, would decrease by approximately 6 dBA over hard surfaces and 9 dBA over soft surfaces for each doubling of the distance. For example, if a noise source produces a noise level of 85 dBA at a reference distance of 50 feet over a hard surface, then the noise level would be 79 dBA at a distance of 100 feet from the noise source, 73 dBA at a distance of 200 feet, and so on. To estimate the attenuation of the noise over a given distance, the following relationship is utilized (California Department of Transportation 1998):

  Equation 1: $dBA_2 = dBA_1 – 20 \log^{(d2/d1)}$

  Where:

  - dBA_2 = dBA at distance 2 from source (predicted)
  - dBA_1 = dBA at distance 1 from source (measured)
  - d_2 = Distance to location 2 from the source
  - d_1 = Distance to location 1 from the source

  The Equivalent Noise Level (Leq), the day-night sound level (Ldn), and the Community Noise Equivalent Level (CNEL) average varying noise exposures over time and quantify the results in terms of a single numeric descriptor. Leq is the average A-weighted sound level measured over a given time interval. Leq can be measured over any period, but is typically measured for 1-minute, 15-minute, 1-hour, or 24-hour periods. Ldn is the energy average of the A-weighted sound levels occurring during a 24-hour period, with 10 dB added to the A-weighted sound levels occurring during the period from 10:00 PM to 7:00 AM. CNEL is the average A-weighted sound level measured over a 24-hour period and is adjusted to account for increased sensitivity of some individuals to noise levels during the evening and nighttime hours. A CNEL noise measurement is obtained by adding 5 dBA to sound levels occurring during the evening from 7:00 PM to 10:00 PM, and 10 dB to sound levels occurring during the nighttime from 10:00 PM to 7:00 AM. The 5 and 10 dB "penalties" are applied to account for peoples' increased sensitivity during the evening and nighttime hours. The logarithmic effect of these additions is that, for example, a 60 dBA 24-hour Leq would result in a CNEL of 66.7 dBA.

4.8.2.2 Existing Noise Conditions in Project Area

Ambient noise is the all-encompassing noise associated with any given environment and is a composite of sounds from many sources. The ambient noise at Bluestone Dam varies continuously, and is composed of sounds from distant sources that are relatively steady, such as the flow of water through the dam, and of other sources, such as traffic sounds along WV Route 20 and roadways within Bellepoint, that vary significantly in duration and magnitude. The CSX railroad line is located just north of Bellepoint and loud noises associated with horn blowing, diesel engines etc., while intermittent, also contribute the ambient noise environment.

With the adoption of the Noise Control Act of 1972, the USEPA (1974) conducted studies on ambient noise to prepare guidelines on noise levels requisite to protect the health and welfare of the general public with an adequate margin of safety. The USEPA issued background information on ambient noise levels throughout the U.S. associated with different living and working environments and guidelines on acceptable noise exposure levels. Noise exposure is regulated for workers; however, there are no Federal, WV, or local (Summers County) regulations or ordinances to limit ambient noise.

Existing site-specific noise monitoring data to delineate actual existing ambient noise levels were available for the areas near the concrete batch plant located in Reconnaissance Area 1. This information was used in conjunction with information taken from the USEPA, DOD, and HUD documents, along with the Handbook of Noise Control (Harris 1979), for various rural and urban environments to estimate ambient noise levels. Baseline noise levels for semi-rural and rural developments throughout the U.S. have been documented in a study performed by the U.S. Department of Defense (DOD), which can be reasonably applied to the project area (DOD 1978).

The land uses associated with most of the study area, except towns and cities such as Hinton, are primarily forest land (70-80 percent), and agricultural land (20-30 percent) with scattered rural residences and farms. Based on data from the USEPA and DOD, ambient day-night (Ldn) noise levels associated with these land uses fall within the range of 40 to 54 dBA, with the lowest ambient noise levels associated with agricultural lands and highest ambient noise levels for forested and small rural residential communities. In addition to site-specific data, these data were used to provide a baseline for evaluating noise impacts. For the purpose of this noise assessment, conservative ambient noise levels are assumed to be 40 dBA for isolated rural developments, and 45 dBA for semi-rural developments. The Bluestone Dam is located close to the community of Bellepoint and the town of Hinton. Ambient noise levels in urbanized areas such as these generally range from 40 to 75 dBA, with night-time being quieter, and noise measured during heavy traffic periods at the upper end of the range. Due to the refraction of sound waves, noise is transmitted easily and quicker across water. Thus, the sound travelling across Bluestone Lake and New River contributes to varying noise levels within the nearby communities.

4.9 Geological Resources

The study area lies within the Appalachian Mountain Belt, which runs from Newfoundland to Alabama. This belt was formed by the collision of large tectonic plates, some 500 million years ago. This process of collision, followed by a period of inactivity, produced old and eroded mountains. Natural geologic events such as erosion and sedimentation have further shaped this mountainous environment within the study area.

4.9.1 Investigative Methods and Resources

The geological resources in the study area were characterized using relevant literature, maps, and state data.

4.9.2 Inventory of Geological Resources

4.9.2.1 Physiography and Topography

The study area is located in two major physiographic provinces: the Appalachian Plateau province and Valley and Ridge province (Figure 4-2). The northern portion of Reconnaissance Area 1 and all of Reconnaissance Areas 2, 3, and 4, lie within the Appalachian Plateau. This province is an accumulation of intramountain plateaus dissected by steep side slopes, with deep entrenched dendritic streams. The V-shaped valleys, floodplains, and terraces are narrow in this region. This topography is typical of much of the WV landscape. The extreme southern portion of Reconnaissance Area 1 is in the Valley and Ridge province. Mountains in this part of the study area are steeper and higher than those just to the north. They are oriented to the northeast and southwest, forming narrow ridgetops, steep mountain sides and large valleys. This area also has rolling hills, throughout the valley. The streams form a trellis pattern through this region. This environment is typical of southwestern Virginia.

The New River basin includes parts of WV, Virginia, and North Carolina. The drainage area of this watershed extending northward to Bluestone Dam is 4,565 square miles. It begins at the New River in the Blue Ridge Mountains of northwest North Carolina. The river flows in a northeasterly direction into Virginia. Then at the Virginia-West Virginia line (Mercer and Summers Counties, WV, and Giles County, VA) the river flows northwesterly until it joins the Gauley River to form the Kanawha River.

The Kanawha River basin drains 12,300 square miles. The Kanawha River flows to Point Pleasant and enters the Ohio River.

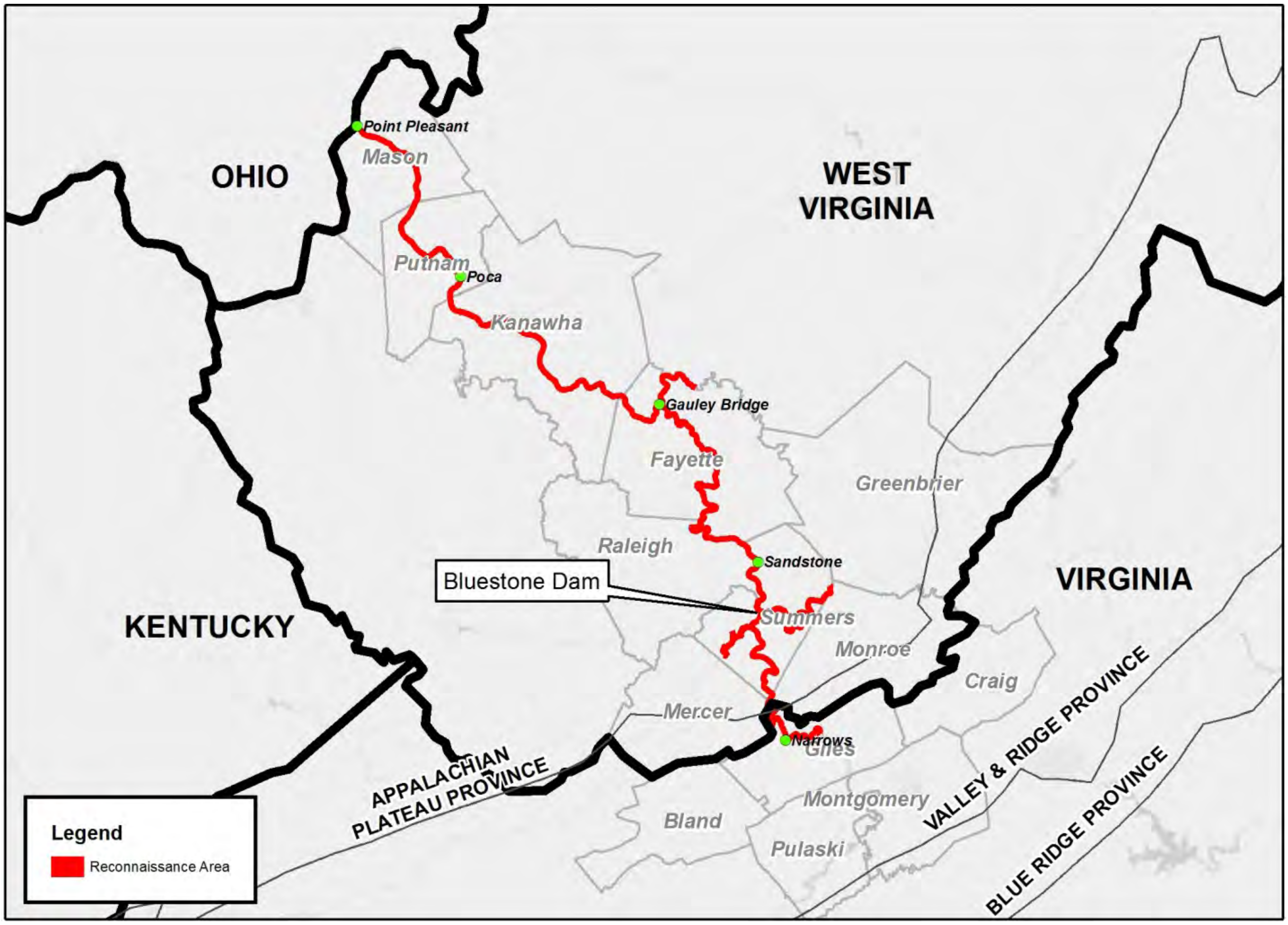


Figure 4-2. Major Physiographic Provinces within the Study Area

4.9.2.2 Geologic Structure and Stratigraphy

Three major geologic periods -- the Devonian, Mississippian, and Pennsylvanian-- are evident in the New River and Kanawha River basins. Within the past 400 million years, major uplifts, marine deposits from huge inland seas, alternating periods of heavy vegetative growth and, finally, extensive erosion activity have combined to produce varied rock strata.

Rocks of the Devonian Period (405 to 345 million years ago) outcrop in the extreme southern portion of the Bluestone Dam study area, approximately along the line separating the two provinces discussed above. Rocks from this period outcrop along the Allegheny Front structure are primarily red beds, shales, sandstone, limestone and chert.

Formations from the Mississippian Period, which began 345 million years ago and lasted some 30 million years, are exposed along a northeast to southwest line; the width of this band in the study area is less than 50 miles. The Pocono Group was the first deposition but it is not well defined; the Maccrady Formation ended the Early Mississippian Period and is present in the study area. During the Middle Mississippian Period the region comprising present WV subsided and a shallow sea again covered the surface. During this time the extensive carbonate deposition which highlights the Greenbrier Group occurred. These limestone deposits are commercially valuable wherever they are near the surface. The westward retreat of the sea marked the end of the last important marine environment in the study area and the beginning of the Late Mississippian with deposition of the Mauch Chunk Group. These sediments of predominant shale and sandstone are the oldest surface rocks found in much of the New River basin.

4.9.2.3 Mineral Resources

Coal is WV's major mineral product. However, since 2013, the state’s coal mining industry experienced significant declines in production and employment due to low world prices, new compliance rules, and competition with shale gas for electricity production. Between 2008 and 2015, state coal production decreased by over 30 percent. Conversely, the state’s production of natural gas increased by an average of 41 percent annually between 2010 and 2015 due to highly productive wells in the Marcellus and Utica Shale plays (WV University 2016). Other minerals include limestone and dolomite, sandstone, salt, clay, sand and gravel (WV Geological and Economic Survey 2016).

Limestone is abundant throughout the study area, especially in Reconnaissance Area 1. It is used for chemical manufacturing, metallurgy, construction, and agriculture. Sandstone, clay and shale, and sand and gravel are also found throughout the study area.

4.10 Soil Resources

Soils and their associations and prime farmlands within the study area are described in this section.

4.10.1 Investigative Methods and Resources

Resources used to complete this section include county soil survey maps and the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) web soil survey which provides soil data and information for many areas within the country.

4.10.2 Inventory of Soil Resources

The SDEIS study area for soils has been defined as a one-half mile corridor along either side of the New River from Narrows, Virginia to Pt. Pleasant, WV, which correlates with the four reconnaissance areas utilized in the 1998 FEIS.

General descriptions of the soils in each association are included in Appendix K.

Four major soil associations occur in the counties within Reconnaissance Area 1.

- Monongahela-Kanawha-Chagrin
- Shouns-Gilpin-Cateache-Berks
- Weikert-Litz-Clarksburg
- Frederick-Carbo

The majority of Reconnaissance Area 2 lies within Fayette and Raleigh Counties, WV. Six major soil associations occur in the study area of Reconnaissance Area 2.

- Monongahela-Kanawha-Chagrin
- Muskinggum
- Gilpin-Dekalb
- Rock outcrop-Gilpin-Dekalb
- Pineville-Gilpin-Dekalb-Buchanan
- Shouns-Gilpin-Cateache-Berks

The majority of Reconnaissance Area 3 is in Kanawha County. Nine major soil associations occur in the study area of Reconnaissance Area 3.

- Urban land-Melvin-Lindside-Kanawha
- Upshur-Gilpin
- Pineville-Gilpin-Dekalb-Buchanan
- Rock outcrop-Gilpin-Dekalb
- Gilpin-Dekalb
- Pineville-Guyandotte-Dekalb
- Pope-Craigsville-Chavies
- Urban land-Laidig-Kanawha
- Vincent-Monongahela

Putnam and Mason Counties lie within Reconnaissance Area 4. Beginning at Poca and moving downstream to Point Pleasant, there are five major soil associations within the study area.

- Sciotoville-Melvin-Lakin-Ashton
- Upshur-Gilpin
- Urban land-Melvin-Lindside-Kanawha

- Sciotoville-Melvin-Lakin-Ashton
- Vandalia-Senecaville-Hackers

4.10.2.1 Prime Farmland

Prime farmland is protected under the Farmland Protection Policy Act (FPPA) of 1980 and 1995. The FPPA's purpose is to minimize the extent to which Federal programs contribute to the unnecessary and irreversible conversion of farmland to non-agricultural uses. As required by Section 1541(b) of Act, 7 U.S. Code (USC) 4202(b), Federal agencies are required (a) to use the criteria to identify and take into account the adverse effects of their programs on the preservation of farmland; (b) to consider alternative actions, as appropriate, that could lessen adverse effects; and (c) to ensure that their programs, to the extent practicable, are compatible with state and local governments and private programs and policies to protect farmland.

The USDA defines prime farmland soil as land with the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops that is available for these uses. Prime farmland generally has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. Some soils identified as prime farmland require measures that overcome hazards or limitations such as flooding or excess wetness or drought. Farmlands of statewide importance nearly meet the criteria for prime farmland, and economically produce high crop yields when treated and managed according to acceptable farming methods.

There are over 300 types of prime farmland soils present within the entire study area. However, if the soils are not available for farmland uses, such as soils subject to excessive erosion, inundation, or urban land use practices, they would not be considered prime farmland.

4.11 Recreation Resources

Recreation was not one of the originally authorized purposes of the Bluestone Dam; however recreation is an inherent competent of the reservoir. Recreation was specifically authorized in 1944. Bluestone offers many quality experiences and diversity of opportunity in the area. The types of recreational opportunities on the upstream side include camping, picnicking, fishing, hunting, hiking, boating, sightseeing, wildlife viewing, kayaking, among other recreational pursuits. Currently the pool experiences fluctuations due to storage of flood waters during storm events and recreational areas are periodically inundated from such events.

On the downstream side, recreation has also been authorized as an official project purpose. Opportunities include camping, fishing, sightseeing, mountain biking, hiking, and whitewater rafting.

4.11.1 Investigative Methods and Resources

Information and data used to compile this section were gathered from internet sources, studies from federal and state agencies, materials provided by USACE, and in-person interviews of recreation facility operators within the region.

4.11.2 Inventory of Recreation Resources

4.11.2.1 Federal Recreation Resources

The largely rugged landscape of WV affords residents and visitors recreation opportunities of considerable breadth and variety. Publicly-owned lands, in particular, provide residents and visitors access to a variety of recreational pursuits. Public-based recreational resources in WV are distributed fairly evenly throughout the state (Figure 4-3). In terms of pure acreage, large tracts of national forest land in the eastern half of the state make up a large percentage of potential total land area available for recreation activities. However, a number of USACE reservoirs, state parks, state forests, and wildlife management areas (WMA) dot the central and western areas of the state, providing accessible outdoor recreation within a relatively short drive for most state residents.

Public providers of outdoor recreation at the federal and state level administer approximately 1.8 million acres of outdoor recreation land in WV (WVDNR 2016). This represents about 11.7 percent of the state's total land area and amounts to about 0.98 acres for each resident of the State (U.S. Census Bureau 2016). Aggregate outdoor recreation land acreage owned by local governments is difficult to obtain, while the recreation land owned by the private sector throughout the state is not known.

At the federal level, the U.S. Forest Service owns and administers three National Forests which lie wholly or partially within West Virginia – Monongahela, Jefferson, and George Washington. Recreation opportunities in these national forests include biking, boating, camping, canoeing, rock climbing, driving for pleasure, fishing, hiking, hunting, whitewater rafting, and wildlife viewing, among others. The NPS operates four units in the state – the New River Gorge National River, the Gauley River National Recreation Area, the Bluestone National Scenic River, and Harper's Ferry National Historical Park. Activities related to recreation on these NPS operated lands are similar to those of the national forests. The USFWS owns and operates two National Wildlife Refuges (NWR) – Canaan Valley NWR and the Ohio River Islands NWR.

Environmental education, fishing, hunting, and wildlife viewing are common forms of recreation at national wildlife refuges. USACE owns and/or operates

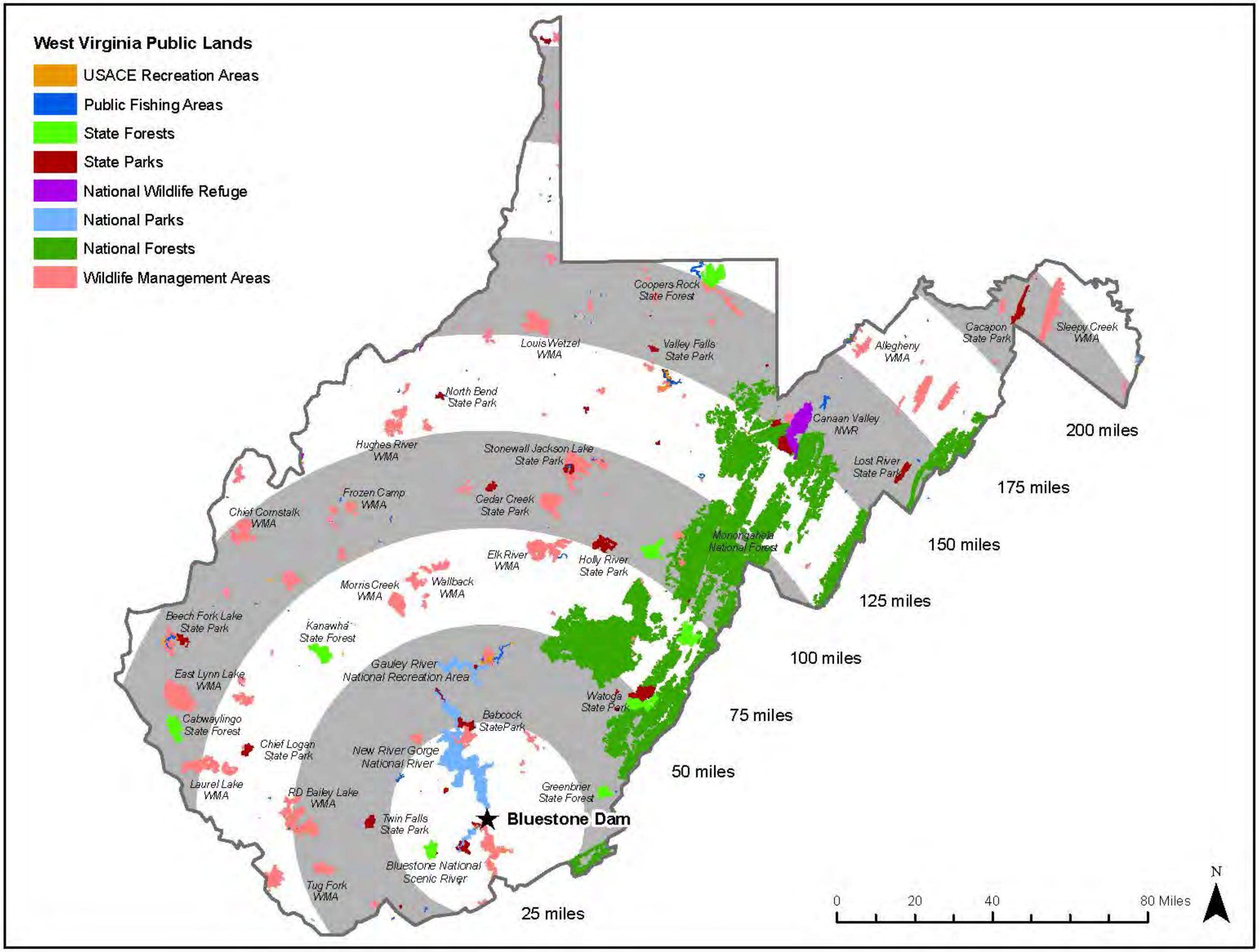


Figure 4-3. Distribution of Public Based Recreation Resources in West Virginia

reservoirs such as Summersville Lake, Beech Fork Lake, Tygart Lake, Bluestone Lake, and R.D. Bailey Lake. In many cases, USACE owns the land, but recreation facilities and land resources are managed, maintained, and operated by the State of WV. Facilities operated on USACE owned land by a State or municipality are permitted subject to an outgrant or lease contract between USACE and the State or municipality. USACE and the State of West Virginia (WV Department of Natural Resources) entered a 25-year lease covering federal lands at Bluestone Lake and Bluestone State Park in May 2000. In the lease agreement, USACE retained the right, at any time, to enter and flood the land, to manipulate the level of the lake or pool, and make any other use of federal lands to accomplish the overall project purpose of flood control. USACE specifically disclaimed liability for any damages resulting from USACE's actions in flooding, manipulating the pool level, or entering federal lands under lease.

Water-based recreation is typical at USACE facilities, but many other types of recreation are offered on these lands and waters. Table 4-12 lists federally held public lands in WV, along with corresponding recreation opportunities available to the public.

The State of WV owns, operates, and/or maintains a wealth of recreational resources. These outdoor recreation lands are comprised of 34 State parks, eight state forests, and 77 wildlife management areas. Figure 4-4 shows the WV recreational resources areas and their respective distances from the Bluestone Dam area. Table 4-13 lists these recreation sites and shows recreation opportunities at each site, total acreage, and driving distance from Bluestone Dam.

4.11.2.2 Regional Recreation Resources

Reconnaissance Area 1 and portions of Reconnaissance Area 2 are located in the area designated as WV Region I of the 11 Regional Planning and Development Councils (McDowell, Mercer, Monroe, Raleigh, Summers, and Wyoming Counties) (Figure 4-5). Within this region, there are a number of public recreation sites at the federal and state level, all of which total approximately 123,186 acres within the Region I boundary. This equates to approximately 0.59 acres/resident, which is significantly less than the State average. Note that municipal and county parks do not figure into this total.

State resources include seven State parks (Bluestone, Camp Creek, Little Beaver, Moncove Lake, Pinnacle Rock, Pipestem Resort, and Twin Falls), one State forest (Camp Creek), and nine areas managed by the WVDNR, including Bluestone, R.D. Bailey, Panther, and Tug Fork Wildlife Management Areas. Federal recreation resources in Region I include a small portion of the Jefferson National Forest (18,902 acres), USACE sites (Bluestone Lake and R.D. Bailey Lake), and the New River Gorge National River (part), with 28,791 acres of NRGNR lying inside of the Region I boundary.

The lower part of Reconnaissance Area 2 and the upstream end of Reconnaissance Area 3 are located in the area designated as WV Region IV (Fayette,

Table 4-12. Federal Lands in WV Available for Outdoor Recreation

Name	Annual Visitation	Agency	Size (acres)	Recreation Opportunities	Driving Distance from Bluestone Dam[1] (miles)
Beech Fork Lake	75,131	USACE	12,755; recreation facilities managed cooperatively by USACE and WVDNR	Boating, fishing, hiking, swimming; see Beech Fork S.P. (nearby), Beech Fork Lake WMA	153
Bluestone Lake	1,513,774	USACE	22,500; recreation facilities managed by USACE and WVDNR	Boating, camping, fishing, hiking, swimming, water skiing; see Bluestone S.P., Bluestone Lake WMA	8
Bluestone National Scenic River	367,331**	NPS	4,336	Hiking, fishing, hunting	13
Burnsville Lake	797,462	USACE	13,322; recreation facilities managed by USACE	Boating, camping, fishing, hiking; see Burnsville Lake WMA	109
Canaan Valley National Wildlife Refuge	Not available	USFWS	16,550	Environmental education, fishing, hunting, wildlife viewing	180
East Lynn Lake	400,172	USACE	24,916; recreation facilities managed USACE	Boating, camping, fishing, swimming; see East Lynn Lake WMA	149
Gauley River National Recreation Area	105,374**	NPS	11,147	Camping, fishing, whitewater rafting	74
George Washington National Forest	Not available	NFS	106,202 (in WV)	Biking, camping, fishing, hiking, hunting	157
Harper's Ferry National Historic Park	282,893**	NPS	1,134	Hiking, historical study	266

Name	Annual Visitation	Agency	Size (acres)	Recreation Opportunities	Driving Distance from Bluestone Dam[1](miles)
Jefferson National Forest	Not available	NFS	18,495 (in WV)	Biking, camping, fishing, hiking, hunting	45
Jennings Randolph Lake	95,706	USACE	4,500	Boating, camping, fishing, hiking, hunting, kayaking, swimming, wildlife viewing	209
Monongahela National Forest	555,000***	NFS	915,165	Boating, camping, climbing, driving for pleasure, fishing, hiking, whitewater rafting	120
New River Gorge National River	1,178,753**	NPS	72,408	Biking, camping, climbing, fishing, hiking, hunting, scenic drives, whitewater rafting	37
Ohio River Islands National Wildlife Refuge	Not available	USFWS	3,440 total (majority of acreage in WV)	Environmental education, fishing, hunting, wildlife viewing	187
R.D. Bailey Lake	452,009	USACE	19,139; recreation facilities managed by USACE	Boating, camping, fishing, hiking; see R.D. Bailey Lake WMA	89
Stonewall Jackson Lake	479,029	USACE	20,451; leased to and managed by WVDNR	See Stonewall Jackson S.P. (nearby), Stonewall Jackson Lake WMA	129
Summersville Lake	889,191	USACE	9,363 owned by USACE	Boating, camping, fishing, hiking, swimming, water skiing; see Summersville Lake WMA	61

Name	Annual Visitation	Agency	Size (acres)	Recreation Opportunities	Driving Distance from Bluestone Dam[1](miles)
Sutton Lake	377,837	USACE	13,375; owned by USACE	Boating, camping, fishing, hiking, swimming, water skiing; see Elk River WMA	101
Tygart Lake	475,233	USACE	4,143 Recreation facilities operated by WV	See Tygart Lake S.P., Pleasant Creek WMA	175

*Sum of Visitation to Sites (2014) in Bluestone WMA; USACE 2016

**2015 estimate; https://irma.nps.gov/Stats/

***2010-2014 estimate; http://apps.fs.usda.gov/nfs/nrm/nvum/results/

[1]Distances derived using 'Driving Distance' function in Google Maps

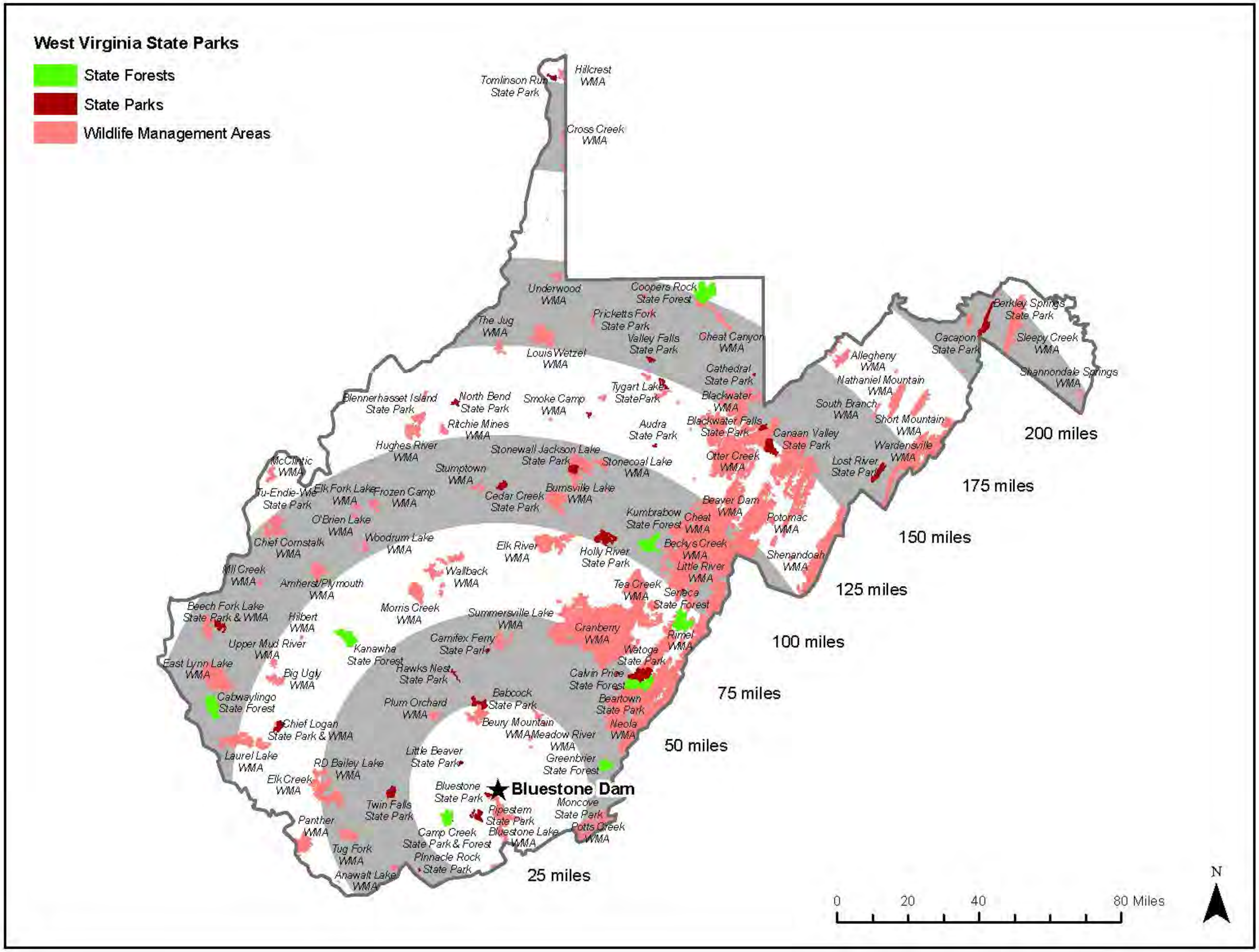


Figure 4-4. West Virginia Recreational Resource Areas

Table 4-13. WV State Parks, Forests, and WMAs

Recreation Site	Type	Size (acres)	Annual Visitation[1]	Recreation Opportunities	Driving Distance from Bluestone Dam (miles)[2]	Number of Campsites
Allegheny	WMA	6,202	Not available	Fishing, hunting	41	N/A
Amherst/Plymouth	WMA	7,061	Not available	Fishing, hunting	117	N/A
Anawalt Lake	WMA	1,792	Not available	Fishing, hunting	59	N/A
Audra	S.P. (Cabin/ Camping/Day Use)	355	151,672	Kayaking, hiking, fishing, camping	157	67
Babcock	S.P. (Cabin/ Camping/Day Use)	4,127	120,491	Paddleboats, rowboats, and canoes are available for rent at the marina, fishing, and hiking trails	36	26
Bear Rock Lakes	WMA	242	Not available	Fishing, hunting (limited)	250	N/A
Beartown	S.P. (Cabin/ Camping/Day Use)	107	32,926	Hiking, observing, bird watching	64	0
Becky Creek	WMA	1,930	Not available	Camping, hunting	129	Unlisted
Beech Fork	S.P. (Cabin/ Camping/Day Use)	3,144	191,835	Kayaking, hiking, fishing, camping, boating, swimming	145	355
Beech Fork Lake	WMA	7,531	Not available	Fishing, hunting, shooting range	153	N/A
Berkeley Springs	S.P. (Cabin/ Camping/Day Use)	5	133,556	Outdoor natural pools	272	0
Berwind Lake	WMA	85	Not available	Fishing, hunting (limited)	73	8
Beury Mountain	WMA	3,061	Not available	Hunting	41	N/A
Big Ditch	WMA	388	Not available	Camping, fishing, hunting	86	N/A
Big Ugly	WMA	6,000	Not available	Hunting	120	N/A

Recreation Site	Type	Size (acres)	Annual Visitation[1]	Recreation Opportunities	Driving Distance from Bluestone Dam (miles)[2]	Number of Campsites
Blennerhassett	S.P. (Cabin/ Camping/Day Use)	509	28,350	Horsedrawn carriage rides, mansion tours, souvenir shop, picnic shelters, and bicycle rentals	174	0
Bluestone	S.P. (Cabin/ Camping/Day Use)	2,100	196,585	Fishing, boating, camping, picnicking, bird watching, and swimming	7	26
Bluestone	WMA	18,019	402,959**	Camping, fishing, hiking, horseback riding, hunting, shooting range	10	330
Buffalo Run	WMA	143	Not available	Fishing, hunting	122	N/A
Burches Run	WMA	55	Not available	Hunting (limited)	253	N/A
Burnsville Lake	WMA	12,579	Not available	Camping, fishing, hunting	109	270 (USACE)
Cabwaylingo	S.F.	8,123	111,450	Swimming, picnicking, game courts, hiking, hunting, and fishing	129	10
Cacapon	S.P. (Lodge/Resort)	6,000	240,902	Golfing, lake activities and hiking opportunities, vacation cabins, restaurant, and golf academy	263	25
*Calvin Price	S.F.	9,482		Hiking, hunting	68	primitive camping only
Camp Creek	S.F.	5,364	see Camp Creek S.P.	Equestrian trails, fishing, historical study, hunting, mountain biking	27	equestrian camp only
Camp Creek	S.P. (Cabin/ Camping/Day Use)	550	141,319	Camping, fishing, game courts, hiking, playgrounds	27	38

Recreation Site	Type	Size (acres)	Annual Visitation[1]	Recreation Opportunities	Driving Distance from Bluestone Dam (miles)[2]	Number of Campsites
Canaan Valley	S.P. (Lodge/Resort)	6,069	274,995	Hiking, biking, swimming, skiing	175	34
Carnifex Ferry	S.P. (Cabin/ Camping/Day Use)	156	66,941	Battleground tours, picnicking, and sports	65	0
Cass Scenic Railroad	S.P. (Cabin/ Camping/Day Use)	940	135,974	Museum and Tours	110	0
Castlemans Run Lake	WMA	486	Not available	Fishing, hunting	251	N/A
Cathedral	S.P. (Cabin/ Camping/Day Use)	133	13,146	Hiking, picnic, and playgrounds	199	0
Cecil H. Underwood	WMA	2,215	Not available	Fishing, hunting	204	N/A
Cedar Creek	S.P. (Cabin/ Camping/Day Use)	2,588	171,329	Game courts, fishing, hiking, and other recreation activity	130	75
Center Branch	WMA	975	Not available	Hunting	149	N/A
Chief Cornstalk	WMA	11,772	Not available	Camping, fishing, hunting	143	15
Chief Logan	S.P. (Lodge/Resort)	4,000	418,012	Game courts, fishing, hiking, and other recreation activity	104	26
Conaway Run Lake	WMA	630	Not available	Camping, fishing, hunting, shooting range	193	10
Coopers Rock	S.F.	12,713	279,011	Picnicking, hiking, biking, hunting, and fishing	196	25
Cross Creek	WMA	2,078	Not available	Fishing, hunting	126	N/A
Droop Mountain	S.P. (Cabin/ Camping/Day Use)	287	52,474	Hiking and picnicking	66	0

Recreation Site	Type	Size (acres)	Annual Visitation[1]	Recreation Opportunities	Driving Distance from Bluestone Dam (miles)[2]	Number of Campsites
Dunkard Fork	WMA	470	Not available	Fishing, hunting (limited)	235	N/A
East Lynn Lake	WMA	22,928	Not available	Camping, fishing, hunting	149	169 (USACE)
Edwards Run	WMA	397	Not available	Camping, fishing, hunting	246	6
Elk Creek	WMA	6,004	Not available	Hunting	82	N/A
Elk River	WMA	18,225	Not available	Camping, fishing, hunting, shooting ranges	90	248 (USACE)
Fairfax Stone	S.P. (Cabin/ Camping/Day Use)	4	2,421	Historical study	187	0
Fort Mill Ridge	WMA	217	Not available	Hunting, fishing	213	N/A
Frozen Camp	WMA	2,598	Not available	Fishing, hunting	142	N/A
Green Bottom	WMA	1,096	Not available	Fishing, hunting	147	N/A
Greenbrier	S.F.	5,100	120,283	Hiking, biking, swimming, picnicking, recreation, hunting, and fishing	50	16
Handley	WMA	784	Not available	Camping, fishing, hunting	71	13
Hawks Nest	Lodge/Resort	276	327,139	Hiking, swimming, tramway, jetboat rides, and rafting	55	31
Hilbert	WMA	289	Not available	Hunting (limited)	156	N/A
Hillcrest	WMA	2,212	Not available	Hunting, shooting range	253	N/A
Holly River	Cabin/Camping/Day Use	8,101	93,177	Hiking, swimming, picnicking, other recreation, and fishing	126	88
Horse Creek Lake	WMA	48	Not available	Fishing, hunting	71	N/A
Hughes River	WMA	10,000	Not available	Fishing, hunting	167	N/A
Huttonsville	WMA	2,720	Not available	Fishing, hunting	127	N/A

Recreation Site	Type	Size (acres)	Annual Visitation[1]	Recreation Opportunities	Driving Distance from Bluestone Dam (miles)[2]	Number of Campsites
Kanawha	S.F.	9,300	295,033	Hiking, biking, swimming, picnicking, recreation, hunting, and fishing	94	46
Kumbrabow	S.F.	9,474	24,328	Hiking, picnicking, hunting, and fishing	126	12
Lantz Farm and Nature Preserve	WMA	555	Not available	Fishing, hunting, hiking	195	N/A
Laurel Lake	WMA	12,856	Not available	Fishing, hunting	117	N/A
Lewis Wetzel	WMA	13,590	Not available	Camping, fishing, hunting, shooting range	212	20
Little Beaver	S.P. (Cabin/ Camping/Day Use)	562	210,315	Paddleboats, playground, hiking, and camping	20	46
Little Indian Creek	WMA	1,036	Not available	Hunting	191	N/A
Lost River	S.P. (Cabin/ Camping/Day Use)	3,712	30,532	Picnicking, horseback riding, swimming, and hiking	195	26
McClintic	WMA	3,655	Not available	Fishing, hunting, shooting range	30	N/A
Meadow River	WMA	2,385	Not available	Hunting	47	N/A
Mill Creek	WMA	1,470	Not available	Hunting	128	N/A
Moncove Lake	S.P. (Cabin/ Camping/Day Use)	250	72,149	Fishing, boating, hunting, camping, picnicking, birding, and hiking	43	48
Moncove Lake	WMA	775	Not available	Fishing, hunting	42	N/A
Morris Creek	WMA	9,874	Not available	Fishing, hunting	75	N/A
Nathaniel Mountain	WMA	10,675	Not available	Camping, hunting	208	75
North Bend	S.P. (Lodge/Resort)	305	183,113	Hiking, swimming pools, boating, biking, and other recreation	165	49

Recreation Site	Type	Size (acres)	Annual Visitation[1]	Recreation Opportunities	Driving Distance from Bluestone Dam (miles)[2]	Number of Campsites
O'Brien Lake	WMA	217	Not available	Fishing, hunting	131	N/A
Panther	WMA	7,810	Not available	Camping, fishing, hiking, hunting, picnicking, playground	91	6
Pedlar	WMA	766	Not available	Fishing, hunting, shooting range	197	N/A
Pinnacle Rock	S.P. (Cabin/ Camping/Day Use)	400	30,480	Hiking, mountain biking, geocaching, and sightseeing	42	0
Pipestem	S.P. (Lodge/Resort)	4,050	344,283	Tramway, swimming, golf, sightseeing, birding, biking, other recreation, fishing, and hiking	13	82
Pleasant Creek	WMA	3,300	Not available	Camping, fishing, hunting	172	40
Plum Orchard Lake	WMA	3,201	Not available	Camping, fishing, hiking, hunting	48	42
Prickett's Fort	S.P. (Cabin/ Camping/Day Use)	22	91,831	Picnicking and sightseeing	173	0
Pruntytown State Farm	WMA	1,764	Not available	Hunting	165	N/A
R.D. Bailey Lake	WMA	17,280	Not available	Camping, fishing, hunting	89	169 (USACE)
Ritchie Mines	WMA	2,300	Not available	Hunting	160	N/A
Rollins Lake	WMA	80	Not available	Fishing	134	N/A
Sand Hill	WMA	967	Not available	Hunting	260	N/A
Seneca	S.F.	11,684	54,215	Hunting, fishing, boating, swimming, golfing, and game courts	100	10
Shannondale Springs	WMA	1,361	Not available	Fishing, hunting	263	N/A
Short Mountain	WMA	8,005	Not available	Camping, fishing, hunting	63	74

Recreation Site	Type	Size (acres)	Annual Visitation[1]	Recreation Opportunities	Driving Distance from Bluestone Dam (miles)[2]	Number of Campsites
Slatyfork	WMA	49	Not available	Fishing, hunting	97	N/A
Sleepy Creek	WMA	22,928	Not available	Camping, fishing, hunting	269	75
Smoke Camp	WMA	252	Not available	Hunting (limited)	168	N/A
Snake Hill	WMA	3,092	Not available	Fishing, hunting	193	N/A
South Branch	WMA	1,092	Not available	Fishing, hunting	168	N/A
Stonecoal Lake	WMA	2,985	Not available	Hunting, fishing	139	N/A
Stonewall	S.P. (Lodge/Resort)	1,736	193,429	Golf, fishing, hiking, camping, boating, mountain biking, swimming	30	46
Stonewall Jackson Lake	WMA	18,289	Not available	Hunting, fishing, shooting range	127	N/A
Stumptown	WMA	1,675	Not available	Fishing (limited), hunting	122	N/A
Summersville Lake	WMA	5,947	Not available	Camping, fishing, hiking, hunting	61	365 (USACE)
Tate Lohr	WMA	500	Not available	Hunting (limited)	38	N/A
Teter Creek	WMA	137	Not available	Camping, fishing, hunting	173	20
The Jug	WMA	2,848	Not available	Fishing, hunting	198	N/A
Thorn Creek	WMA	528	Not available	Fly-fishing only, hunting	140	N/A
Tomlinson Run	S.P. (Cabin/ Camping/Day Use)	1,398	140,506	Fishing, recreation, hiking, and picnicking	267	54
Tu-Endie-Wei	S.P. (Cabin/ Camping/Day Use)	4	29,600	Historical study	149	0
Tug Fork	WMA	2,165	Not available	Fishing, hunting	180	N/A
Turkey Run	WMA	27	Not available	Fishing	146	N/A
Twin Falls	S.P. (Lodge/Resort)	3,776	144,154	Hiking, golf, picnicking, swimming, and mountain biking	46	50

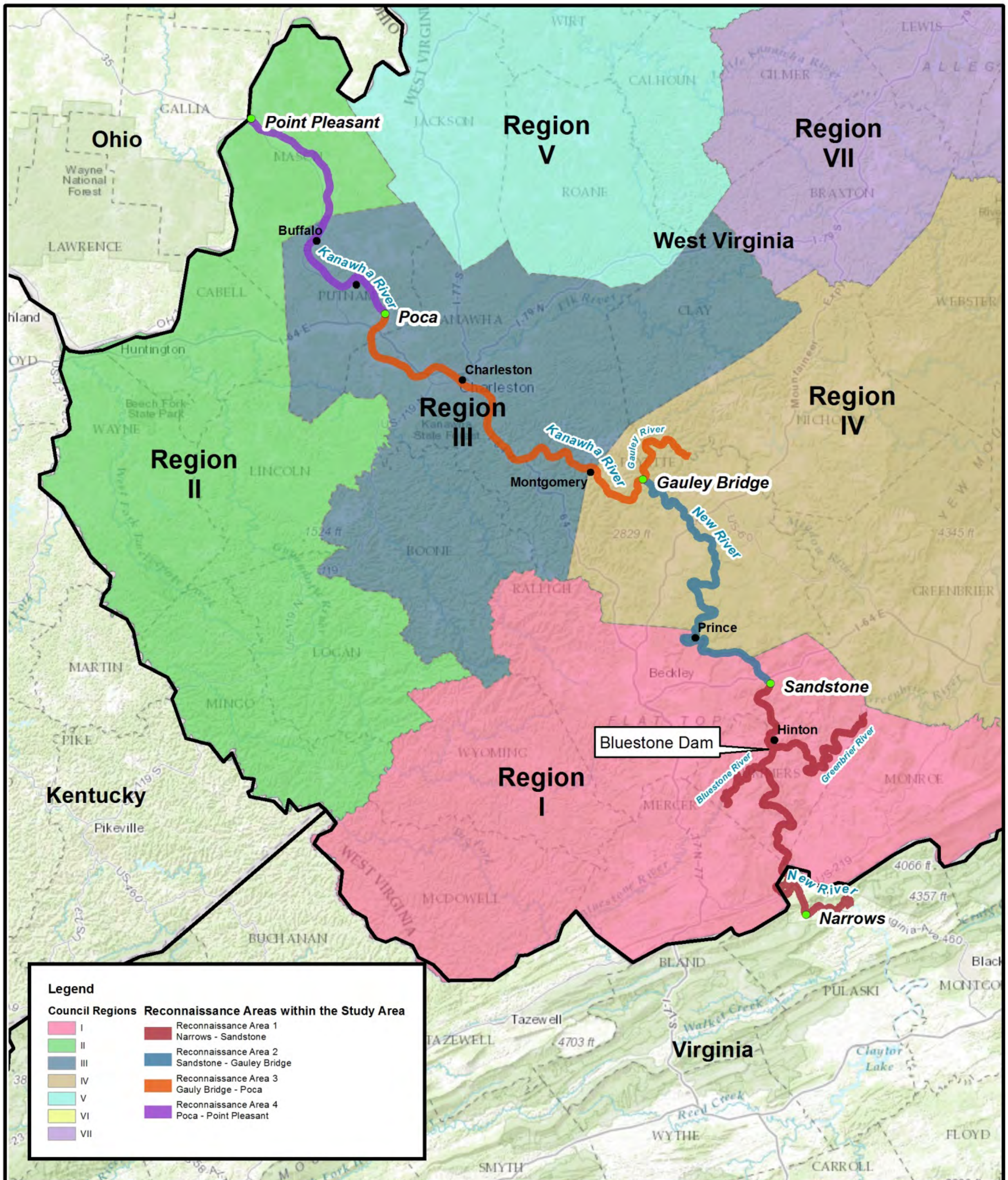
Recreation Site	Type	Size (acres)	Annual Visitation[1]	Recreation Opportunities	Driving Distance from Bluestone Dam (miles)[2]	Number of Campsites
Tygart Lake	S.P. (Lodge/Resort)	1,750	251,216	Fishing, picnicking, golfing, hiking, boating, kayaking, and geocaching	175	40
Upper Deckers Creek	WMA	56	Not available	Fishing, hunting (limited)	197	N/A
Upper Mud River	WMA	1,425	Not available	Fishing, hunting, picnicking, softball, swimming	124	N/A
Valley Bend	WMA	31	Not available	Fishing, hunting (limited)	135	N/A
Valley Falls	S.P. (Cabin/ Camping/Day Use)	1,145	77,503	Fishing, hiking, horseshoes, picnicking, playground, sightseeing	198	0
Wallback	WMA	11,758	Not available	Fishing, hunting, shooting range	112	N/A
Warden Lake	WMA	110	Not available	Fishing	229	N/A
Watoga	S.P. (Cabin/ Camping/Day Use)	10,100	246,219	Boating, camping, game courts, fishing, hiking, swimming	75	88
Watter Smith	S.P. (Cabin/ Camping/Day Use)	532	69,203	Birding, hiking, biking, recreation, and picnicking	142	0
Widmeyer	WMA	422	Not available	Hunting	264	N/A
Woodrum Lake	WMA	1,696	Not available	Fishing, hunting	127	N/A

[1]Total Party Days/Nights, *The Economic Significance and Impacts of West Virginia's State Parks and Forests*, Dec. 2015.

[2]Distances derived using 'Driving Distance' function in Google Maps.

*Calvin Price: Very small unmonitored attendance; not included in the above study.

**Sum of Visitation to Sites (2014) in Bluestone WMA; USACE 2016.



REGIONAL PLANNING AND DEVELOPMENT COUNCIL REGIONS WITHIN STUDY AREA
Bluestone Dam SEIS

ECS - GEC JV
Figure: 4-5
Date: June 2016
Scale:1:1,400,000
Source: ESRI/GEC
Map ID: 0027970110000-3178

Greenbrier, Nicholas, Pocahontas, and Webster Counties). The region consists of 42 Federal and State outdoor recreation sites (all or portions of) with a total acreage of 637,130 acres, or approximately 5.16 acres/resident for the region's 123,469 residents, significantly above the State average. Note that municipal and county parks do not figure into this total.

The majority of the New River Gorge National River lies in Region IV (43,606 acres), as well as Federal resources including a portion of the Monongahela National Forest (507,757 acres), and Summersville Lake (USACE).

4.11.2.3 Outdoor Recreation Resources at the Bluestone Lake and Vicinity

The Bluestone Lake vicinity stands out as offering a rich, diverse source of recreation opportunities. Recreation resources range from highly developed facilities for such activities as organized conferences, motorized boating and fishing and trailer camping to more remote, undeveloped resources that accommodate non-motorized boating and fishing, hunting, primitive camping, hiking, and similar activities. In the period from 1984-2015, average annual visitation to recreation sites on Bluestone Project lands was 970,189 (per the 1998 FEIS, the Bluestone Project includes the dam, Bluestone Lake, and adjacent USACE lands). Table 4-14 shows monthly visitation from 2014.

4.11.2.4 Upstream Resources

On the upstream side of the dam, Bluestone Lake itself is considered a major recreation resource. Centered three miles southwest of the dam, 2,154-acre Bluestone State Park is managed by the State on land that is primarily owned (76 percent) by USACE. The remainder of the park lies on State-owned lands. Bluestone State Park saw an annual average of 265,721 recreation visits between 1984 and 2015. Primary recreation activities at the park include boating, camping, fishing, and hiking. The park offers 26 cabins and 226 campsites which are heavily occupied from spring through early fall, particularly on holiday weekends. In addition, the park offers multiple boat launches including the "Pit" area, which is the launching area for Bluestone Lake boat races and bass fishing tournaments. The racers and their crews occupy the "Pit area" which is the Bluestone State Park launch ramp located in the parking lot near the Lilly Bridge.

The Bluestone WMA is approximately 18,019 acres of (primarily) USACE land which was out granted to the WVDNR for fish and wildlife management purposes. Area-wise, Bluestone WMA is the fifth largest public wildlife management area managed by the WVDNR. In 2009, the WMA saw 168,587 recreation visits (WVDNR 2009). The key forms of outdoor recreation at Bluestone WMA are camping, fishing, and hunting.

Sites and corresponding facilities in Bluestone WMA which are contiguous to the lake are listed as follows, moving upstream:

Table 4-14. Monthly Visitation to Recreation Sites at the Bluestone Project (2014)

Recreation Area	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEPT	Monthly Mean Visitation by Area	Total Annual Visitation
Bertha	1,782	1,535	604	507	390	767	2,407	3,429	4,796	4,534	3,381	3,115	2,271	27,246
Bluestone Conference Center	1,175	881	113	122	121	216	940	3,316	2,974	4,188	2,598	3,047	1,641	19,690
Bluestone State Park	8,667	6,613	4,434	3,408	4,881	9,186	14,588	25,396	27,273	44,064	28,865	21,374	16,562	198,748
Bull Falls	1,029	1,030	717	225	167	428	1,012	1,768	1,490	1,821	1,868	2,195	1,146	13,749
Cedar Branch	893	947	499	339	221	527	1,540	2,900	3,512	2,930	1,888	1,455	1,471	17,651
Downstream #1	18,878	8,765	5,293	8,181	8,724	20,745	38,945	44,776	47,586	62,380	60,235	20,439	28,745	344,946
Downstream #2	6,933	3,628	2,172	1,991	2,354	4,788	8,145	12,577	15,762	14,069	12,176	6,620	7,601	91,214
Mouth of Indian Creek	2,824	2,231	774	1,471	1,373	2,124	4,035	6,850	11,608	7,380	4,944	4,410	4,169	50,022
Shanklin's Ferry	1,327	1,145	526	631	421	805	1,868	3,162	5,497	5,230	3,660	1,820	2,174	26,092
Town Park - City of Hinton	5,330	4,815	4,392	3,509	3,417	5,115	10,178	12,343	14,150	14,833	14,597	7,462	8,345	100,140
Town Park - Glen Lyn, VA	2,389	1,756	1,097	1,323	1,371	2,664	6,178	13,764	15,484	16,307	9,699	3,818	6,321	75,852
Subtotals	51,229	33,346	20,621	21,708	23,439	47,364	89,834	130,280	150,131	177,736	143,910	75,754		965,350

Source: USACE 2016.

- Bertha Camping Area (one boat ramp lane, 55 campsites, restrooms)
- Bull Falls Camping Area (one boat ramp lane, 20 campsites, restrooms)
- Indian Creek Camping Area (carry down access for small boats, 100 campsites, restrooms)
- Cedar Branch Camping Area (carry down access for small boats, 45 campsites, restrooms)
- Shanklin's Ferry Camping Area (carry down access for small boats, 80 campsites, restrooms)

Other identified recreation sites include the Glen Lyn City Park and the Bluestone Camp and Retreat (formerly known as the Bluestone Conference Center). Glen Lyn City Park visitation accounted for almost 8 percent of all visits to the Project area in 2014, while the Bluestone Camp and Retreat accounted for only 2 percent of all visits. Glen Lyn City Park is a popular facility operated by the Town of Glen Lyn, Virginia. It consists of 18 acres of land including a boat launch and 42 campsites with electrical hook ups. The retreat, which was developed in the 1950s, sits on 405 acres and is operated by the Presbytery of WV. The facility includes 60 campgrounds leased on a yearly basis as well as cabins that are rented mostly by church groups in the summer.

The New River upstream of Bluestone Dam is characterized by active recreational use including canoeing, kayaking, tubing, swimming, and fishing. South of the US Rt. 460 bridge at Glen Lyn, primary activities include fishing, boating, picnicking, and camping at privately operated camps along the river. Public access points to the river occur at several locations along the stretch of river from Glen Lyn upstream beyond the original Bluestone Project boundary. This section does not have much whitewater use, either private or commercial. Because of the excellent population of native smallmouth bass, rock bass, and bluegills, this segment is a popular fishing destination. The quality of the scenery in this area is generally very high, having spectacular limestone cliffs.

As previously stated, USACE has continued to manage all of the Bluestone project area (formerly known as "Project lands"), but has leased most of the recreation sites to others – the State of WV, City of Hinton, the Town of Glen Lyn, and Bluestone Conference Center and Retreat. It should be noted that presently, the primitive campsites operated by the State of WV within the WMA are not in use due to budgetary constraints. Summers County, during the 2016 recreation season, has been temporarily operating and maintaining these primitive sites. An sub-lease agreement between WVDNR and Summers County would be executed for long term maintenance of the areas.

4.11.2.5 Downstream Resources

Over half of the recreation visits to the immediate Bluestone area are concentrated at sites downstream of the dam. Of these downstream sites, the two downstream tailwater sites managed by the USACE receive the highest proportion of overall recreation use, with 436,160 visits in 2014 (45.2 percent). These sites are immediately downstream of the dam, are easily accessible and due to the exceptional habitat and biodiversity is one of the most popular fishing sites in the region. There is an ADA-accessible fishing pier available to the public on the left downstream bank, which is well utilized by the public. These downstream areas provide direct access to numerous anglers to fish within the river every day of the week. In addition to fishing, other activities and facilities at these sites include picnic facilities, parking areas, and walkways.

Immediately downstream of these sites and east of the river are 3.24 acres of land leased to the City of Hinton, which manages the area as a city park. This park contains ball fields; tennis and basketball courts; parking for 129 vehicles; a boat slide for paddlers; a covered shelter with picnic tables; and a playground. A batch plant used for concrete production to facilitate ongoing construction activity at the dam necessitated removal of a baseball field, fitness trails, and open space which were once features of the park. Overall, the area managed by Hinton accounted for 100,140 visits in 2014, or 10.4 percent of the total of visitation of the original USACE lands.

Combined, these downstream areas account for over half of all recorded recreation visits to the Bluestone project area. All visits at these sites are for day-use activities. Further downstream, the NPS manages two significant recreation sites: the New River Gorge National River (NRGNR) and the Gauley River National Recreation River (GRNRR). The NRGNR, established in 1978, begins at Hinton and extends 53 miles downstream. Facilities include visitor centers, river access points, trails, and scenic overlooks. This section of the New River is well-known for fishing and particularly for whitewater boating. The New River falls 750 feet in 53 miles from the Bluestone Dam to the confluence of the Gauley River, and is considered one of the best whitewater rivers in the U.S. Most of the whitewater use is on the lower New River, from Cunard to just below the New River Gorge Bridge, where rapids are classified as having a higher degree of difficulty. Commercial trips typically start at Stone Cliff, Thurmond, or Cunard, and take-out near Fayette Station. The actual location of the put-in and take-out varies according to the activities of each whitewater outfitting company. A substantial proportion of this river use takes place during July and August when relatively low flow conditions exist on the New River.

The NPS estimated the number of visits to these three river resources in 2015 to be approximately 1,320,860 visits (242,245 visitor days). It is not clear whether this use figure includes whitewater boaters. The distribution of visits, visitor days and total overnight stays to these river resources is presented in Table 4-15.

Table 4-15. Total Recreation Visits and Overnight Stays for NPS Sites Near the Study Area (2015)

River Resource	Visits	Visitor Days	Total Overnight Stays
Bluestone National Scenic River	36,733	7,635	0
New River Gorge National River	1,178,753	206,807	5,630
Gauley River National Recreation Area	105,374	27,803	7,071

4.11.2.6 Recreation Activity Preferences

According to the data collected by Southwick Associates, Inc., the most popular activity (in 2005) was wildlife viewing, followed by camping, trail hiking, fishing, bicycling, hunting, paddling, and snow sports. Table 4-16 shows participation rates of WV residents participating in common outdoor recreation activities.

Table 4-16. Outdoor Recreation Participation for WV Residents

Activity	% of population*	Number of participants	
		Outdoor Industry Foundation Report*	2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation**
Wildlife Viewing (away from home)	33%	500,000[1]	348,000
Camping (RV, tent, rustic lodging)	28%	402,077	N/A
Trail (hiking on unpaved trail, backpacking, rock climbing)	27%	379,596	N/A
Fishing	16%	241,750[1]	305,000
Bicycling	16%	228,244	N/A
Hunting	15%	225,107[1]	247,000
Paddling (kayaking, rafting, canoeing)	8%	114,409	N/A
Snow Sports	6%	82,620	N/A

*Southwick Associates 2006

**from *2011 Survey of Fishing, Hunting, & Wildlife-Associated Recreation* (FHWAR)

[1]Data from the 2001 National Survey of Fishing, Hunting and Wildlife-Associated Recreation" commissioned by USFWS was used to create participation data

4.12 Visual/Aesthetic Resources

4.12.1 Investigative Methods and Resources

The USACE Visual Resources Assessment Procedure (VRAP) is a method to evaluate visual resources which could be impacted by a USACE project (Smardon *et al.* 1988). The VRAP has two primary components: 1) the Management Classification System (MCS) and 2) the Visual Impact Assessment (VIA). The MCS provides a framework for judging visual quality of a project area. Given that all impacts to visual resources would occur within the immediate area of the dam, an abbreviated form of the MCS was utilized to inventory visual resources within the project area, and the inventory was restricted to Reconnaissance Area 1.

4.12.2 Inventory of Visual/Aesthetic Resources

Visual character refers to a description of the predominant features of a landscape that, collectively, define the visual quality of the landscape. The regional landscape within Reconnaissance Area 1 is a fairly homogenous, unified landscape of similar dramatic visual character. Reconnaissance Area 1 downstream of the dam contains a portion of the New River Gorge National River between Hinton and Sandstone, which contains landscape features dominated by the New River itself and narrow floodplains of varying width. The New River in this area contains a number of water features of visual interest, including Sandstone Falls and Brooks Falls. The viewshed surrounding the river includes mountains with slopes containing forests and rim rock cliffs. Approximately 83 percent of the New River Gorge National River is occupied by upland deciduous forests (Vanderhorst 2007). With the exception of the communities of Bellepoint, Hinton, Barksdale, Brooks, and Sandstone, the downstream area provides a nearly uninterrupted natural viewshed in which the limited urban and rural development of towns and agricultural fields within the floodplain are somewhat dwarfed by the magnitude of the surrounding natural landscape.

Views of the river and surrounding landscape are available from overlooks in the community of Bellepoint and town of Hinton. Past Hinton, near, mid, and long views of the surrounding landscape downstream of the dam are accessible via WV Route 20 on the right descending bank and New River Road on the left descending bank. While views of the river and riverbanks are somewhat obscured by deciduous trees on the roadside of WV Route 20, this route provides scenic overlooks and river and hiking trailhead access points, giving viewers opportunities for longer viewings of the wider landscape of not only the New River Gorge National River, but also the wider Appalachian Plateau landscape outside the park (NPS 2009b). New River Road is the only riverside road within the New River Gorge National River, giving viewers relatively unobscured views of the river, riverbanks, and mountain slopes. These dramatic views are also accessible from the river itself, as the area is used extensively for rafting and kayaking.

The distinct visual quality of the New River Gorge National River was part of the impetus for federal designation of the area, and this distinct quality remains relatively unencumbered in much of the viewshed, as the park is managed in part to protect scenic resources in and around the New River Gorge. However, local communities have approved private development within the park boundaries, which would cause adverse impacts to the visual resources experienced from the river, roads, trails and overlooks in some areas (NPS 2009a). Because 22 percent or 16,286 acres of lands inside the park boundary are under private ownership, the NPS has noted development within the park may fragment the contiguous visual nature of the forest within the gorge (NPS 2011b). While the NPS must comply with non-degradation and enhancement policies associated with the river's federal designation, it is not able to compel private entities to necessarily comply with these policies (NPS 2009a).

Bluestone Dam is visually disjointed from the largely natural landscape that surrounds it, though the community of Bellepoint downstream of and adjacent to the dam lends a more developed aesthetic to the immediate landscape. The aesthetic quality of the immediate area has also been lessened over the past 20 years, as construction equipment surrounding the dam has created a more industrial aesthetic. The dam does, however, provide opportunities for viewing the more natural landscape downstream of the tailwater area, with a scenic overlook and ADA-accessible fishing pier providing public access adjacent to the stilling basin.

The terrain upstream of the dam is largely similar to the terrain seen downstream. Immediately upstream of the dam, Bluestone Lake provides ample land-based and water-based opportunities for landscape viewing. As one travels further upstream, the narrow views within the steep forested mountain terrain widen to offer views of more distant ridgelines.

While numerous streams within the Appalachian Plateau are considered visually appealing, this portion of the New River upstream of the dam's immediate rural recreational development to Glen Lyn, VA is visually distinct because the wide riparian corridor is less developed than other scenic rivers and streams in the area (NPS 2009a). No major roads or railroads parallel the river throughout most of the upstream area within Reconnaissance Area 1 below Glyn Lyn, and the limited agricultural development in a portion of the river valley aesthetically blends with the surrounding natural landscape. Opportunities for near, mid, and long views exist from the river itself, and from several public camping and river access sites.

The distinct visual quality of this portion of the New River upstream of the dam led, in part, to the NPS considering federal designation of the reach as a Wild and Scenic River. While a 2009 study by the NPS determined that this segment of the river was not suitable for designation due to a lack of immediate threats to the river and a lack of commitment by all of the management agencies to implement all of the resource management proposals considered in the designation, the study nonetheless recognized the distinct and high visual quality of the area.

4.13 Cultural Resources

This section of the SDEIS includes an inventory of previously recorded cultural resources and known archeological and historic properties located within the Area of Potential Effect (APE) for each reconnaissance area of the proposed project.

4.13.1 Investigative Methods and Resources

Information for preparation of this section was found in the following reports: "Phase IA Cultural Resources Investigation for the Bluestone Dam Safety Assurance Program," (USACE 1997a), "Determination of Eligibility Assessments of Bluestone Dam and for County Route 23, Vicinity of Hinton, Summers County, WV" (USACE 1997b), "Historic Documentation Report, Bluestone Dam, Hinton Vicinity, Summers County, West Virginia" (Hardlines Design Company 2002), and "Update to the Historic Properties Management Plan for Bluestone Lake in West Virginia" (Cultural Resource Analysts 2006) . This section summarizes the information found in those reports which are included in Appendix G. No field studies were conducted to identify or assess potentially eligible prehistoric or historic properties that could be located in the APE.

4.13.2 Inventory of Cultural Resources

The Area of Potential Effects (APE) is defined in the regulations implementing the Section 106 review process as the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of cultural resources. Areas within one mile in either direction of the activities described in the alternatives were included in the APE. The APE, extending from south of Narrows, VA, near Bluff City, VA, to Point Pleasant, WV, on the Ohio River, has a rich pre-historic and historic heritage extending from the Paleo-Indian Period (15,000 B.C.) to the historic (present) for occupation.

During the 1997 Phase I Investigation conducted by USACE, USGS quadrangle maps and county files containing location data for archeological sites and historic structures in or near the APE were examined, and the locations and agency designations of all recorded archeological resources National Register historic districts were transferred to maps. During the investigation, site forms for prehistoric properties were reviewed, and NRHP properties were reviewed and tabulated (Appendix G).

The Phase I Investigation determined that over 600 prehistoric and historic recorded archeological sites lie within a one-mile radius of the APE. Over 200 historic standing structures and 13 historic districts also lie within a one-mile radius of the APE. The majority of these known cultural resources are downstream of the Bluestone Dam. Within Reconnaissance Area 1 there are 235 prehistoric and historic archeological sites, 3 historic districts, and 14 historic properties. Within Reconnaissance Area 2 there are 24 prehistoric and historic archeological sites, 1 historic district, and 26 historic properties. Within Reconnaissance Area 3 there are 133 prehistoric and historic archeological sites, 7 historic districts, and 67 historic properties. Within Reconnaissance Area 4 there are 154 prehistoric and historic archeological sites, 2 historic districts, and 112 historic properties. A detailed listing of all previously recorded cultural resources and historic districts can be found in the Phase IA Cultural Resources Investigation and Update to the Historic Properties Management Plan (Appendix G).

4.13.2.1 Summary of Previous Archaeological Investigations Within Reconnaissance Area 1

Several cultural resource studies have been previously conducted within the vicinity of the current APE.

Although many cultural resource surveys have been completed in the downstream area, only one has been conducted upstream of the dam (Reconnaissance Area 1). Ralph Solecki of the Smithsonian Institution conducted the first archeological survey for the Bluestone Dam in 1948. Sites were generally recorded based on local informant interviews only. Because his focus was on floodplain tracts, only 28 sites were identified and recorded. And to date only three archeological sites (46SU3, 46SU9, and 46SU22) have been significantly tested in the upstream area.

In 1977, the University of Pittsburgh's Archeological Research Program performed archaeological testing on sites in the area. While the surveyed area was within the vicinity, none of the sites tested for eligibility were located within the current APE.

In 1979, the University of Akron conducted investigations of two sites. Controlled excavation identified features at both site locations with refuse/storage pits, burials, and a variety of artifact types including lithic, bone, and shell.

In 1980, Soil Systems Inc. performed a Phase I archeological survey for the Columbia Gas Transmission Line Corridors Projects 80-8 and 80-2. The survey was conducted in the central part of WV and included Summers County.

In 1985, another cultural resources survey was conducted in Summers County. The report submitted to the Summers County Historical Landmark Commission was entitled "An Historical and Archaeological Survey of the Bluestone River, Madam Creek and the Jumping Branch/Nimitz Areas of Summers County, West Virginia." No archeological sites were found in the APE.

In 1991, documentary research and a preliminary survey of frontier forts in the Bluestone Reservoir, New River Valley in Summers County, WV was conducted by the University of Kentucky Cultural Resource Assessment Program. Three sites were investigated.

In 1994 Gray & Pape, Inc. conducted a Phase I survey for a proposed water treatment plant and force main water pipeline close to Bluestone Lake. Results from the 23-acre investigation identified two sites that are not located within the APE of this project.

In 1995, Cultural Resource Analysts, Inc. performed a Phase I survey in to "locate, describe, evaluate and make appropriate recommendations for the future treatment of any historic properties or sites threatened by the proposed developments" (Anslinger 1995). Three unrecorded sites were identified during the survey. Of the sites recorded in the CRA study, only 46SU617, is located within the current APE and identified as an open habitation site.

In 1997, an assessment of the Bluestone Dam and a nearby segment of former County Rt. 23 were conducted for eligibility for listing on the NRHP. The report of findings, “Determination of Eligibility Assessments of Bluestone Dam and for County Route 23, Vicinity of Hinton, Summers County, West Virginia" is included in Appendix G. Bluestone Dam was determined eligible for listing on the NRHP, Criterion A. In 2000, consultation with the SHPO concerning the eligibility of Bluestone Dam and potential for cultural resources within the APE for the 1998 DSAS dam modifications led to the development of a Memorandum of Agreement (MOA) to satisfy the requirement for Section 106 between the SHPO, Advisory Council on Historic Preservation (ACHP), and USACE. The MOA is included in Appendix G. As per the MOA, the recordation and historic documentation of Bluestone Dam was completed in 2002 (Hardlines Design Company 2002).

4.13.2.2 Upstream Area

The Bluestone Lake area has been the site of vigorous looting activity for more than 50 years. Many sites have been identified in all topographic locations, from floodplains, terraces, ridge tops, and steep slopes. There are over 100 archeological sites which may occur upstream of Bluestone Dam within the APE (USACE 1997; Cultural Resource Analysts 2006). The potential for encountering additional archeological sites does exist upstream. Recently, there has been some incidents of inadvertent discoveries of human remains and funerary objects from the shoreline of Bluestone Lake. In accordance with the Native American Graves Protection and Repatriation Act (NAGPRA), USACE took the necessary steps to secure and protect the location, as well as initiated consultation with Tribes who claim cultural affiliation to the region. Monitoring and reporting standards have been developed through tribal consultation and SHPO coordination to ensure the preservation of archeological sites within the Bluestone Lake.

4.13.2.3 Downstream Area

The downstream areas, encompassed by Reconnaissance Areas 2, 3, and 4 (with a portion of Reconnaissance Area 1) contain documented evidence of over 500 sites identified within one mile of the study area, ranging from the Paleo-Indian to historic-period site. Several historic and prehistoric sites have been archeologically excavated in the downstream area including the Saint Albans, Hansford, and Buffalo sites. In NRHP listing, 13 historic districts and more than 60 historic standing structures were identified in the downstream APE.

4.14 Socioeconomic Resources

In this section social, economic, and environmental justice issues are addressed.

4.14.1 Investigative Methods and Resources

The socioeconomic resources in the study area were characterized using existing literature, the U.S. Census Bureau, and previous studies of the project area.

4.14.2 Inventory of Socioeconomic Resources

- Upstream Characteristics and Development
  Bluestone Lake, including its maximum flood control pool at 1,520 feet elevation, lies predominantly in Summers County, WV, with minor portions in Monroe and Mercer Counties, WV, and Giles County, VA. The Bluestone and Greenbrier Rivers are tributaries of New River. No railroads, one State and one Federal highway are in the reservoir area, but both are located above 1,520 feet.

- Downstream Characteristics and Development
  The New, Greenbrier, Gauley, Elk, and Kanawha Rivers are the major streams downstream of Bluestone Lake. In Reconnaissance Areas 1 and 2, the downstream New River valley consists of comparatively small towns and rural residences which are generally located along the main stream. Downstream of Gauley Bridge in Reconnaissance Area 3, the Kanawha River valley is much more urban and commercialized up to Winfield, when the valley becomes rural once again. The valley floor from the Fayette-Kanawha Counties line to Poca in Putnam County, is a heavily populated industrial belt containing numerous plants, as well as intensive residential and commercial development. Several of the medium to large communities in the area are Hinton, Montgomery, Chesapeake, Belle, Charleston, South Charleston, Institute, St. Albans, and Nitro. The valley in Reconnaissance Area 4, from Poca to Point Pleasant, is more rural with small communities and agricultural fields scattered along the wide floodplain.

  Within Reconnaissance Areas 1 and 2 and the southernmost portion of Reconnaissance Area 3, the useable land near the New River and Kanawha River basins is typically limited to the narrow floodplains of the streams. In some areas the floodplain of the New River is narrow. Because of this, a relatively large population has been concentrated into densely populated ribbons and pockets of settlements along the stream bank. The study area downstream from Raleigh County through Kanawha County contains large quantities of high-grade bituminous coal which often outcrop on the hillsides.

4.14.2.1 Economy

The economic development of Reconnaissance Areas 3 and 4 has paralleled the navigational development of the Kanawha River. The river, as a transportation route as well as a source of water supply, has helped bring economic growth and prosperity to the area from the early days of salt production, timbering, coal mining, and, chemical production. Coal is WV's major mineral product. The economy of the basin historically has experienced irregular periods of growth and decline characteristic of the mineral extraction industry. Historically, the area depended heavily on coal mining as a basic export industry. However, since 2013, the state's coal mining industry experienced significant declines in production and employment due to low world prices, new compliance rules, and competition with shale gas for electricity production. Between 2008 and 2015, state coal production decreased by over 30 percent. Conversely, while not occurring locally in the counties near the Bluestone Dam, the state's production of natural gas increased by an average of 41 percent annually between 2010 and 2015 due to highly productive wells in the Marcellus and Utica Shale plays (WV University 2016).

4.14.2.2 Population Demographics

Population and demographic characteristics for the study area within close proximity to the dam were obtained from the projected 2015 U.S. Census Bureau. County-specific information is provided in Table 4-17. State-specific information is provided in Table 4-18.

Table 4-17. Population and Demographic Characteristics for Counties Upstream and Immediately Downstream of Bluestone Dam

Category	Giles County, VA	Mercer County, WV	Monroe County, WV	Summers County, WV	Raleigh County, WV
Population	16,708	61,164	13,506	13,239	77,510
White Alone	96.5%	91.2%	97.2%	93.0%	88.5%
African-American	1.6%	6.3%	0.8%	4.8%	8.3%
American Indian	0.2%	0.2%	0.2%	0.0%	0.3%
Asian	0.5%	0.6%	0.2%	0.2%	1.1%
Hispanic or Latino	1.6%	1.0%	0.9%	1.4%	1.5%
Median Income	$45,919	$35,678	$38,239	$35,040	$41,152
High School Graduates	83.1%	82.0%	81.0%	81.1%	82.9%
College Graduates	17.0%	19.0%	13.8%	13.0%	18.2%
Percent Minority	3.5%	8.8%	2.8%	7.0%	17.5%
Percent in Poverty	13.5%	20.5%	19.3%	25.8%	17.7%

Source: United States Census Bureau, 2015.

Table 4-18. Population and Demographic Characteristics for Virginia and West Virginia

Category	West Virginia	Virginia
Population	1,850,326	8,326,289
White Alone	93.7%	70.5%
African-American	3.6%	19.7%
American Indian	0.2%	0.4%
Asian	0.8%	6.3%
Hispanic or Latino	1.5%	8.9%
Median Income	$41,576	$64,792
High School Graduates	84.4%	87.9%
College Graduates	18.7%	35.8%
Percent Minority	6.4%	29.8%
Percent in Poverty	18.3%	11.8%

Source: United States Census Bureau 2015.

Summers and Mercer counties closely represent the demographic characteristics of WV as a whole. Monroe County has a lower percentage of minorities while Raleigh County has a lower percentage of white alone population than WV. Giles County has a higher percentage of white alone population than Virginia as a whole. African-American, Asian, and Hispanic or Latino populations are lower in Giles County than in the state of Virginia.

Since 2010, Summers County has seen a nearly five percent decrease in the population. Mercer County has seen the most change over the past few decades with nearly a 20 percent drop in the population since 1950. Giles County has maintained a consistent population since the 1960s and has only seen minor increases and decreases.

4.14.2.3 Employment

Total employment for the Kanawha River valley peaked in about 1950, and then declined about 17 percent until 1970. National employment increased by 37 percent during this period. From 1970 to 1980, employment increased about 30 percent, which was above the growth rate for both WV and the nation. From 1980 to 1990, however, employment decreased by about 8 percent. During the same period, the State employment decreased 3 percent while the national average increased 18 percent. The leading employment categories in 1990 were services, wholesale and retail trades, mineral extraction, and manufacturing.

From 2010-2014, the total percent of the population in the labor force for the nation was at 63.5 percent. Virginia had 64.8 percent of the population in the work force and WV had 54.2 percent of the population in the workforce. From 2010 to 2014, the U.S. had 14.8 percent of the population living in poverty. Virginia had 11.8 percent and WV had 18.3 percent of the population living in poverty.

4.14.2.4 Housing

A building boom peaked in the Kanawha River valley in 1979 due to interest rates spiraling to record highs in 1980 and 1981. Factors which influenced the past high demand for additional dwelling units during the 1970s included: a strong local economy with relatively low unemployment rates; expansion of major employers in the valley coupled with the transferring of large numbers of employees from other areas of the U.S. to the region; a decrease in the number of persons per household; a loss of existing housing units due to interstate highway construction; a loss of housing units due to flooding; and urban renewal clearing policies. Recently, the request for building permits within Summers County has been low.

The majority of new single-family housing in the valley has been developed in subdivisions. Over 40 subdivisions were in some stage of development at the beginning of the 1980s. Housing in the New River valley downstream of Hinton is only a small fraction of the density in the Kanawha River valley. Both valleys, however, have a wide range in housing quality, with the average quality being highest in the central part of the Kanawha River valley.

The current average sale price for homes in WV is $139,273, indicating that sale prices tend to be lower in WV than in the rest of the U.S., where the average sale price is $263,262.

Although sale prices in WV are on the rise, they are growing more slowly than in the U.S. as a whole. The average sale price in WV increased by 2.48 percent from a year ago, compared to 5.72 percent growth seen across the U.S.

4.14.2.5 Schools

Summers County, WV has one public high school, Summers County High School, which serves students in grades nine to twelve; and one middle school, Summers Middle School, which serves students in grades five to eight. Summers County has three elementary schools: Hinton Elementary, Jumping Branch Elementary, and Talcott Elementary which serve grades pre-kindergarten to fifth grade. Summers County also has one private School, Pipestem Christian Academy.

The Mercer County Public School System has nineteen elementary schools, including Athens, Bluefield Intermediate, Bluewell, Brushfork, Ceres, Glenwood Elementary, Lashmeet-Matoaka, Melrose, Memorial, Mercer County Early Learning - Bluefield and Princeton sites, Mercer, Montcalm, Oakvale, Princeton Primary, Spanishburg, Straley, Sun Valley and Whitethorne. There are six middle school facilities including Princeton Middle, Bluefield Middle, Montcalm Middle, PikeView Middle, and Glenwood Middle. There are also four high school facilities including Princeton Senior, Bluefield High, Montcalm High, and PikeView High. There is also the Mercer County Technical Education Center, which is currently being transitioned into a comprehensive technical high school. Mercer County Schools educates approximately 9,200 students. The professional and service staff is about 1,200. Higher educational institutions include Bluefield State College, located in Bluefield, Concord University, located in Athens and New River Community and Technical College, located in Princeton, WV.

Giles County, VA has three elementary and middle schools. These are Eastern Elementary School, Macy McClaugherty, and Narrows Elementary/Middle School. Narrows High School and Giles High School are also located in Mercer County.

4.14.2.6 Community Cohesion

Community cohesion is the unifying force of conditions that provide commonality within a group. It has also been used to describe patterns of social networking within a community. Community cohesion refers to the common vision and sense of belonging within a community that is created and sustained by the extensive development of individual relationships that are social, economic, cultural, and historical in nature. The degree to which these relationships are facilitated and made effective is contingent upon the spatial configuration of the community itself; the functionality of the community owes much to the physical landscape within which it is set. The viability of community cohesion is compromised to the extent to which these physical features are exposed to interference from outside sources.

The identities of the local residents are deeply rooted in the communities that surround the Bluestone Dam, which offer an environment where residents can connect with nature and enjoy common interests and values. These communities use the water resources created by the Bluestone project as a place where they can connect for festivals, family reunions, family vacations, and other social events.

4.14.2.7 Transportation

The study area has a generally adequate system of State and Federal highways, which include interstate and U.S. highways and Appalachian corridors. Major north-south highways serving the area are I-77, I-79, U.S. Rt. 19 (Appalachian Corridor L), U.S. Rt. 119 (Appalachian Corridor G), and U.S. Rt. 35. The WV Turnpike, between Charleston and Bluefield, is part of I-77 which extends north to Cleveland, OH, and south into Virginia and the Carolinas; I-79 extends from Charleston north to Lake Erie via Pittsburgh; and U.S. Rt. 35 extends from Charleston northwest to Dayton, OH. Appalachian Corridor G will link Charleston with Pikeville, KY, when completed. Major east-west highways serving the area are I-64 and U.S. Rt. 60. I-64 connects Charleston with St. Louis, MO, by way of Huntington, WV, Lexington and Louisville, KY. It extends east from Charleston to Richmond, VA, crossing the New River at Sandstone. U.S. Rt. 60 runs generally parallel to I-64 from Louisville through Charleston to Richmond.

Development of the railway system in the study area was brought about by the need to service the timber and coal-mining industries. The potential for developing regional coal and timber resources prompted railroad companies to extend their principal lines and develop numerous branch lines to serve new coal mines and specific timbering areas. The region is now covered by an extensive rail network that in many cases permits rail transport from mines to points of destination. The CSX Transportation railroad is a major freight carrier in the region, while Amtrak is a passenger line that runs in the region through Hinton below the dam. Both of these railroad lines are largely protected by the Bluestone Dam. In addition, complementary relationships with other transportation facilities serve areas not having direct access to railroad lines; rail-to-water loading facilities are provided at several points along the Ohio and Kanawha Rivers.

There are 37 airports in WV for public use including five commercial services (primary airports), two commercial services (non-primary airports), and several general aviation airports. The commercial service – primary airports are publicly owned and have more than 10,000 boardings each year. The non-primary airports have less than 2,500 boardings per year. There are no international airports in WV. The airports closest to the project area include Raleigh County Memorial Airport at Beckley, Mercer County Airport, Hinton-Alderson Airport, and Greenbrier Valley Airport at Lewisburg.

Aside from 91 miles of the Kanawha River and a short reach of the Elk River, the only other navigable waterway contiguous to the study area is the Ohio River at Mason County. The area is linked by waterway to the upper Ohio basin by way of the Ohio, Monongahela, and Allegheny Rivers; to the upper Midwest and the Great Lakes by the Upper Mississippi and Illinois Rivers; to the lower Ohio basin by the Ohio, Tennessee and Cumberland Rivers; and to the Gulf Coast along the lower Mississippi River and the Gulf Intercoastal Waterway.

Access to waterway transportation is limited to a great extent by the design and nature of waterway terminals in the primary study area. River terminals and docks in this area are essentially private, single-purpose, and single-user facilities, providing a narrow range of services directly related to the needs of individual firms. Waterway carriers servicing the study area include operators of both single vessels and extensive fleets. The waterway shippers include regulated carriers, exempt carriers and private carriers. In addition, there are numerous large marinas located along the navigable section of the Kanawha River and pleasure boating is a common water sport in those areas.

4.14.2.8 Land Use

Most of the land in the study area is covered with second growth forests. Timbering operations were originally developed to provide wood supports for use in the mines. Lumber is now used for the manufacture of furniture, pallets, and building materials. Although lumbering is increasing in the study area, no large volume of commercial activity is expected to develop.

Agricultural land is located in the Kanawha River basin. Following national and state trends, agriculture is declining in importance to the economy of the area.

Most of the industry in the basin is concentrated in Kanawha County along the floodplain. Significant concentrations also occur along the Kanawha River in

Putnam and Fayette Counties. These industrial areas have displaced agriculture and housing uses, and new developments will continue this pattern into the future. One of the largest areas of potential industrial sites is in Mason and Putnam Counties on floodplain now used for agriculture. Substantial tracts of land in this corridor are owned by energy companies and other corporations and much of the land is leased for agriculture until a future need is identified. Floodplain along the Kanawha River is easily accessible to transportation systems, utilities, and services. The large trained labor force, the relatively low cost of floodplain land, and the accessibility of raw materials has resulted in the present high degree of floodplain development. Prime farmland soils are located within the study area. Details regarding prime farmland can be found in Section 4.10.

4.14.2.9 Recreation

As an authorized purpose of the Bluestone Dam, the recreation opportunities in the area offer a unique experience for both local and out of town visitors. The area's natural landscape along with developed campgrounds and recreation areas offer its users with a vast array of recreational options.

The types of recreational opportunities on the upstream side include camping, picnicking, fishing, hunting, hiking, boating, sightseeing, bird watching, kayaking, along with many other activities. A more detailed discussion of recreation resources is included in Section 4.11.

4.14.2.10 Environmental Justice

NEPA studies of USACE activities must consider, within the impact analysis of the proposed action and alternatives, the potential of disproportionately high adverse human health or environmental effects on certain populations (942 USC Section 4321; EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, Feb. 11, 1994). Environmental justice concerns may arise from impacts on the natural or physical environment or from related social or economic impacts. Analysis of demographic data on race and ethnicity and poverty provides information on minority and low-income populations that could be affected by the proposed actions. Where possible and appropriate, this analysis should incorporate consideration of any potential multiple and cumulative exposures to environmental hazards for low income and minority populations (Executive Order 12892, 59 Federal Register Section 3-3). In order to meet these obligations, the USACE reviewed available U.S. Census Bureau records to determine the composition of the affected communities to determine whether minority communities or low-income communities were present within the impact area and if so, whether any identified impacts might result in disproportionately high and adverse effects on those communities.

The projected 2015 Census reports numbers of minority individuals and the American Community Survey provides the most recent poverty estimates available. Minority populations are those persons who identify themselves as Black, Hispanic, Asian American, American Indian/Alaskan Native, Pacific Islander, or Other. Poverty status is used to define low-income. Poverty is defined as the number of people with income below poverty level, which was $24,250 for a family of four in 2015, according to the U.S. Census Bureau. A potential disproportionate impact may occur when the minority in the study area exceeds 50 percent and/or the percent low-income exceeds 20 percent of the population. Additionally, a disproportionate impact may occur when the percent minority and/or low-income in the study area are meaningfully greater than those in the region. Tables 4-17 and 4-18 lists the percent of low-income population and percent considered minority within the counties located in the study area.

4.14.2.11 Protection of Children

EO 13045 requires each Federal agency "to identify and assess environmental health risks and safety risks that may disproportionately affect children" and "ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks." This EO was prompted by the recognition that children, still undergoing physiological growth and development, are more sensitive to adverse environmental health and safety risks than adults. The potential for impacts on the health and safety of children is greater where projects are located near residential areas.

4.15 Public Safety Resources

This section addresses public safety including the probability of injuries, loss of human life, and accidental release of pollutants.

4.15.1 Investigative Methods and Resources

Information was obtained from USACE provided risk assessment data and State of WV and Kanawha and Putnam county emergency management offices.

4.15.2 Inventory of Public Safety Resources

The Bluestone Dam has controlled flooding and protected downstream populations and property since operation of the dam began. It is estimated by USACE that approximately $2.26 billion in damages have been prevented by the dam. The flood risk management benefits have been realized in the community of Hinton, immediately downstream of the dam, along with many other communities along the New and Kanawha Rivers. Downstream of Hinton, the river enters the New River Gorge within the New River Valley which has little to no riverside development. Significant development near or within the inundation areas does not begin until 65 miles below the dam within the Kanawha River Valley, where the New and Gauley Rivers converge to form the Kanawha River near the Town of Gauley Bridge. This increase in development continues downstream to Charleston, which is located 104 miles downstream of the dam, and where several smaller communities are located including Montgomery, Glasgow, Marmet, and Kanawha City. Development beyond Charleston includes the cities of South Charleston, Institute, St. Albans, Nitro, Winfield, and Point Pleasant (Figure 4-6).

Over the years, the dam and the protection that it provides have allowed industrial development downstream in the Kanawha River Valley, also known as Chemical Valley, which is located in Reconnaissance Area 3. The annual flows that are sustained by the Bluestone Dam support many permitted outfalls in the developed area of the Kanawha River Valley. The chemical sector supports approximately 22,000 jobs in Kanawha and Putnam counties and includes major chemical plants such as DuPont, Dow/Union Carbide, and Bayer, along with several other smaller plants located within the Kanawha River Valley. Other Kanawha valley industries include heavy steel fabricating, glass manufacturing, and energy development. These types of industries typically manufacture, use, or dispose of hazardous substances. Several notable chemical spills have occurred in the Chemical Valley. The most recent was the Elk River chemical spill in 2014, which was the third chemical accident to occur in the Kanawha River Valley within five years. The chemical was a type of foam used to wash coal and was released from a facility in Charleston, WV into the Elk River, which is a tributary of the Kanawha River. Portions of nine counties and approximately 300,000 residents were affected by the spill.

Although there is not a lot of development within the inundation areas in the New River Valley, there are a number of potable water and sewer treatment plants located in cities and towns throughout the study area, especially within the Kanawha River Valley. One of the region's largest power suppliers and five large hospitals are also located within or near the Kanawha River valley.

4.16 Hazardous, Toxic, and Radioactive Waste

4.16.1 Investigative Methods and Resources

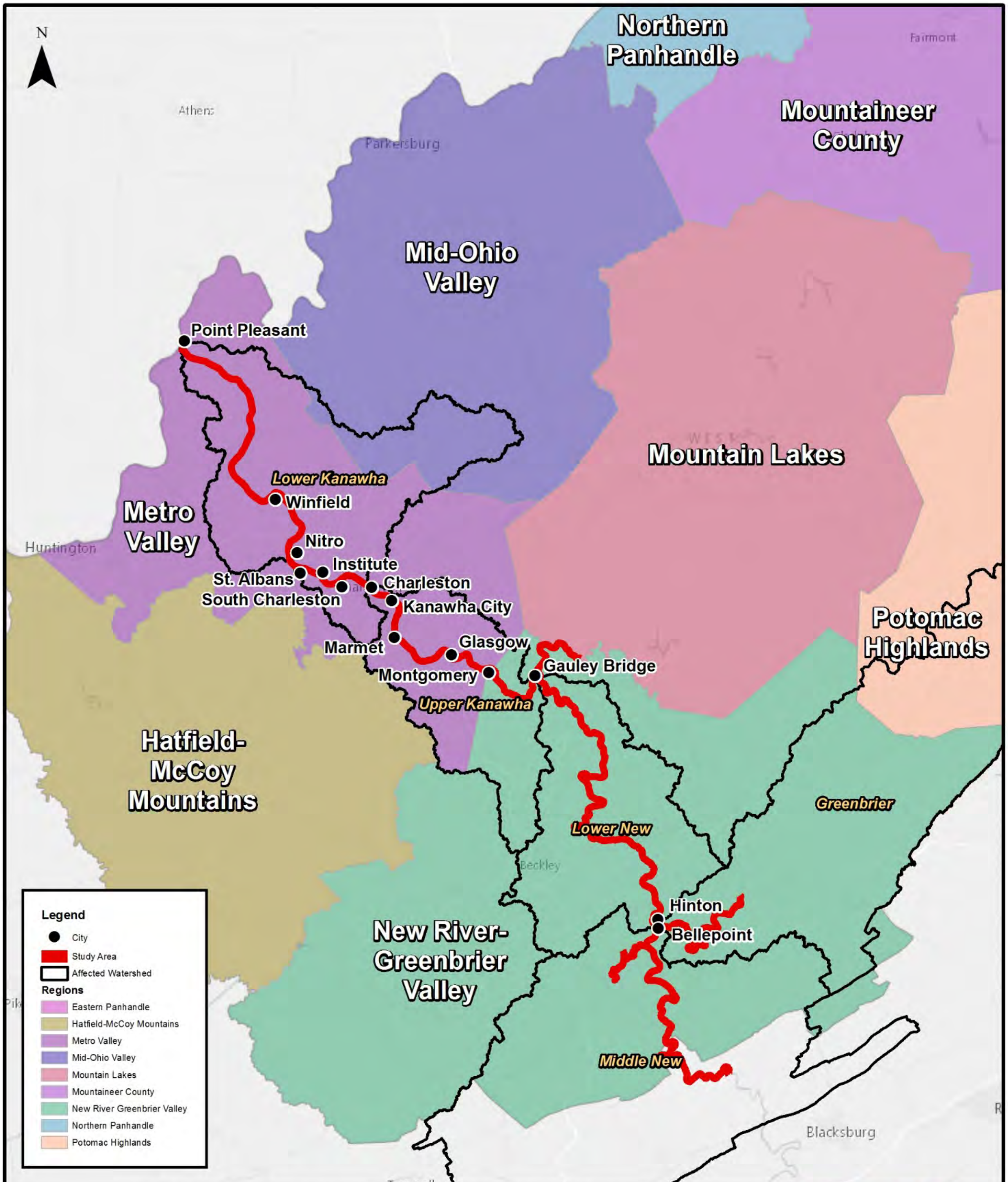
Resources used include USACE provided data and Phase I Environmental Site Assessment (ESA) reports.

4.16.2 Inventory of Hazardous, Toxic, and Radioactive Waste

The USACE is obligated under ER 1165-2-132 to assume responsibility for reasonable identification and evaluation of all hazardous, toxic, and radioactive waste (HTRW) contamination within the vicinity of the project boundaries.

4.16.2.1 Phase I HTRW Investigation

A Phase I HTRW Investigation is intended to include the review of any conditions that would be within the scope of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), Resource Conservation and Recovery Act (RCRA), and other environmental laws and regulations. These investigations are based on the generally accepted standard practiced provided in ASTM E 1527-15, *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process* (ASTM 2015), ASTM E 1528-14, *Standard*



COMMUNITIES AND REGIONS LOCATED WITHIN THE STUDY AREA

Bluestone Dam SEIS

Service Layer Credits: Esri, HERE, DeLorme, MapmyIndia, © OpenStreetMap contributors, and the GIS user community

ECS - GEC JV

Figure: 4-6	
Date: June 2016	
Scale: 1:1,200,000	
Source: ESRI/GEC	
MapID: 0027970110000-3178	

Practice for Environmental Site Assessments: Transaction Screening Process (ASTM 2014), USACE Huntington District ISO 9001 procedures, and USACE HTRW policies. Activities for the Phase I HTRW assessment consist of, but are not limited to, a record search (60+ year ownership histories from the courthouse, appropriate regulatory agencies, etc.), an onsite field investigation, and interviews with current and past owners to determine the history of the properties' past land use. The intent of the Phase I HTRW Investigations was to identify the potential for any environmental concerns on the areas investigated, any recognized environmental conditions (REC), and to determine the necessity for additional HTRW investigations, including Phase II (a) HTRW Investigations.

Environmental professionals conducted the field investigation of the proposed CWL in March and May 2016. The Phase I Environmental Site Assessment (ESA), Bluestone Dam Contractor Work Limits (CWL) for Dam Safety Modification Study, Hinton, WV, June 2016 (USACE 2016e) is included in Appendix L. During the physical inspection, the ground surface of the area was examined for signs of contamination. Specific indicators of possible environmental contamination include stained soil, stressed vegetation, surface debris, underground storage tank (UST) fill caps or vent lines, and unusual ground depressions or formations. The site reconnaissance also included the assessment of the potential for contamination from activities on adjacent areas. During the physical inspection, the ground surface of the area was examined for signs of contamination. Based on this assessment, no additional HTRW Investigations are required for the project area investigated.

4.16.2.2 Phase II (a) HTRW Investigation

Phase II (a) HTRW Investigations are intended to evaluate the RECs identified in the Phase I HTRW Investigation for the purpose of providing sufficient information regarding the nature and extent of contamination (through sampling of media) to assist in making informed business decisions concerning the property. These investigations are based on the generally accepted standard practiced provided in ASTM E 1903-11, *Standard Practice for Environmental Site Assessments: Phase II Environmental Site Assessment Process* (ASTM 2011), as well as the references listed below. Rights-of-Entry are required from the property owner in order to conduct any Phase II (a) HTRW Investigations. If the presence of contamination is conclusively identified by the Phase II (a) HTRW Investigation, in-depth investigations to quantify the types and extent of contamination present would be required. Of the areas investigated, no Phase II (a) HTRW Investigations or further investigation activities were recommended for the project area.

To date, no known Phase II (a) HTRW Investigations have been conducted on tracts/areas investigated for this project. Where changed conditions indicate the potential exists for hazardous substances regulated under CERCLA or hazardous wastes regulated under RCRA, a Phase II (a) HTRW investigations would be performed.

4.17 Other Social Effects

This section outlines potential Other Social Effects (OSE) due to ongoing DSA construction (Phase 3 and Phase 4) and subsequent TSP construction using guidance from the *Handbook on Applying "Other Social Effects" Factors in Corps of Engineers Water Resources Planning* (USACE 2009) to identify how current and planned construction would impact project area social connectedness, local economies, community, and resiliency. OSE is one of USACEs four major water resources accounts that are to be considered in project analysis and decision making along with National Economic Development (NED), Environmental Quality (EQ), and Regional Economic Development (RED).

4.17.1 Investigative Methods and Resources

Information is derived from literature searches for secondary data sources. However, limited firsthand data was collected from interviews in May 2016 with officials from the City of Hinton, the Hinton Chamber of Commerce, and project area recreation facility operators.

4.17.2 Inventory of Other Social Effects

The immediate Bluestone Dam project area includes four counties: Giles County in Virginia, and Mercer, Monroe, and Summers counties in WV. This area is culturally and geographically distinct, in part, because of its beautiful landscape and water resources. However, declining coal and associated rail activity have negatively impacted the area: unemployment rates and poverty levels are higher than national averages, and population is shrinking (refer to Tables 4-17 and 4-18).

Because project area water resources provide important recreational and economic opportunities, this section attempts to identify how they affect local social characteristics, economies, and culture.

4.17.2.1 Summers County, WV - Inventory of Other Social Effects

Summers County, WV, has the greatest potential to be impacted by DSA and TSP construction at Bluestone Dam. Sparsely populated and rural, most of the population is located near the county seat, Hinton. Residents and visitors enjoy a mountainous landscape with fertile valleys offering scenic views and an active outdoor lifestyle. The county hosts the WV State Water Festival, powerboat races, and several bass fishing tournaments.

4.17.2.1.1 Summers County, WV – Socioeconomic Data

Table 4-19 displays 2015 U.S. Census data for population statistics. Since 2010, overall population has decreased nearly five percent as younger residents have moved for better economic opportunities. However, due to its natural beauty and recreation opportunities, the number of retirees living in the area has increased. As a result, the area has experienced an increased need for medical services.

Table 4-19. Summers County Population Statistics Distribution

Subject	Summers County, WV	Hinton, WV
Population		
Population estimates, July 1, 2015, (V2015)	13,239	2,528
Population estimates, July 1, 2014, (V2014)	13,417	2,556
Population estimates base, April 1, 2010, (V2015)	13,927	2,672
Population estimates base, April 1, 2010, (V2014)	13,927	2,676
Population, percent change - April 1, 2010 (estimates base) to July 1, 2015, (V2015)	-4.9	-5.4
Population, percent change - April 1, 2010 (estimates base) to July 1, 2014, (V2014)	-3.7	-4.5
Population, Census, April 1, 2010	13,927	2,676
Population, Census, 2000	12,999	2,880
Age and Sex		
Persons under 5 years, percent, July 1, 2014, (V2014)	4.1	3.1
Persons under 5 years, percent, April 1, 2010	4.5	5.6
Persons under 5 years, percent, 2000	4.6	4.5
Persons under 18 years, percent, July 1, 2014, (V2014)	17.1	13.8
Persons under 18 years, percent, April 1, 2010	18.1	19.4
Persons under 18 years, percent, 2000	20.5	19.4
Persons 65 years and over, percent, July 1, 2014, (V2014)	21.1	32.6
Persons 65 years and over, percent, April 1, 2010	19.3	19.4
Persons 65 years and over, percent, 2000	19.9	26.2
Female persons, percent, July 1, 2014, (V2014)	55.2	53.3
Female persons, percent, April 1, 2010	55.1	53.4
Female persons, percent, 2000	51.1	54.8

Source: U.S. Census Bureau 2015a; U.S. Census Bureau 2000.

Table 4-20 presents housing and employment statistics from 2015 U.S. Census Bureau data, which reflect the area's economic downturn. The data also indicate low household income for Summers County than the state and national average, which is $41,576 and $53,482 respectively. The data also indicate a lower percentage of college graduates than the state and national average, which is 18.7 percent and 29.3 percent, respectively,

Table 4-20. Summers County Housing, Education, and Employment Statistics

Subject	Summers County, WV	Hinton, WV
Housing		
Housing units, July 1, 2015, (V2015)	7,668	1,628
Housing units, April 1, 2010	7,680	1,604
Families and Living Arrangements		
Households, 2010-2014	5,560	1,276
Persons per household, 2010-2014	2.25	2.07
Education		
High school graduate or higher, percent of persons age 25 years+, 2010-2014	81.1	76.6
Bachelor's degree or higher, percent of persons age 25 years+, 2010-2014	13.0	16.9
Economy		
In civilian labor force, total, percent of population age 16 years+, 2010-2014	44.3	40.9
Income and Poverty		
Median household income (in 2014 dollars), 2010-2014	\$35,040	\$29,865
Per capita income in past 12 months (in 2014 dollars), 2010-2014	\$19,181	\$19,756
Persons in poverty, percent	25.8	24.2%
Businesses		
Total employer establishments, 2014	160	124
Total employment, 2014	1,392	847
Total annual payroll, 2014 (\$1,000)	38,961	13,528
Total employment, percent change, 2013-2014	-0.4	0.5
Total nonemployer establishments, 2013	474	N/A

Source: U.S. Census Bureau 2015a.

4.17.2.1.2 Summers County Overview

The City of Hinton emerged with rail construction after the Civil War infrastructure destroyed during the war was replaced and expanded. Hinton served as the main terminal for the Chesapeake and Ohio (C&O) Railroad, which employed 540 employees at its peak, and the city's population grew significantly, to nearly 9,000 residents, between 1895 and 1907, when most of the rail construction occurred. During this time, several buildings were constructed that are now listed in the National Register of Historic Places.

As locomotive and rail technologies changed after World War II, the railroad industry shifted from Hinton and the area underwent changes. Fortunately for the town, the Bluestone Dam was completed in 1949 followed by the establishment of

Bluestone Public Hunting and Fishing Area and Bluestone State Park. This brought a resurgence in Hinton's economy, and the economic focus turned to tourism (City of Hinton 2016). Currently, tourism is one of the biggest economic drivers of the area although that industry has also suffered in recent years as the economic recession has negatively impacted vacation and leisure activities in southern WV. As a result of the national recession, the number of visitors to the area declined from three million, annually, in 1993 to less than one million in 2014 (USACE 2016a).

Summers County has a county commission made up of a president and county commissioners that meets once a month. The City of Hinton has a city council made up of councilmembers and the mayor.

4.17.2.1.3 Summers County Recreation

Summers County possesses significant recreation opportunities (public lands, lakes, rivers etc.) important to the local culture and economy. These include Bluestone State Park, Bluestone Wildlife Management Area, New River Gorge National Park, Bluestone Lake, New River, Bluestone River, and Hinton Recreation area. Local culture is tied closely to these areas, and residents identify themselves with associated pursuits such as fishing, hunting, boating and sports.

Bluestone Lake Marina is located on the upstream side of Bluestone Dam and serves the area local communities with year-round dockage for boats. From April to October it also operates Jet Ski and kayak rentals. The Hinton Recreation area is located downstream of Bluestone Dam and provides facilities for sports, fishing, and picnicking. The facilities are important to Hinton since they provide the city's sole source of recreation related to organized baseball activities.

An ADA-accessible fishing pier is located at the downstream side of Bluestone Dam and offers convenient access for fishing. Residents and visitors use this pier extensively.

4.17.2.1.4 Summers County Festivals and Organized Events

Water-related recreation opportunities provided by Bluestone Lake and the operation of the dam are important to local residents and visitors. The development of Bluestone Lake and surrounding recreational lands provide opportunities for individuals and group activities, and they also provide good areas for festivals and other events. The City of Hinton hosts numerous events some of which are closely related to Bluestone Lake and the downstream area of the dam. The WV State Water Festival offers family-oriented activities including live music, craft, car and art shows, parades, and more. It usually occurs in the first part of August and provides a large boost to the local economy (Visit Southern WV 2016).

The annual powerboat races that take place on Bluestone Lake in June are also significant. The racers and their crews occupy the "Pit" area during this time and take advantage of local hotels, shopping, and restaurants in Summers County and surrounding counties. These races draw 500-700 visitors and many locals to the area.

Bluestone Dam offers anglers some of the best fishing in WV, and numerous state-record catches were made in Bluestone Lake and New River. Hinton hosts several bass tournaments throughout the year that draw anglers nationwide. In 2016, the lake will host 16 tournaments from June to November. These events are a source of pride and excitement for local residents.

4.17.2.1.5 Summers County Organizations

Summers County is home to 63 churches representing numerous denominations of faith (Homefacts 2016). The Summers County historical society is a non-profit organization committed to preserving and sharing the county's history and culture. Its mission includes publishing materials to educate future generations about the area's history (Summers County Historical Society 2016). At this time USACE is not aware of other organizations.

4.17.2.2 Mercer, Monroe County, WV and Giles County, Virginia - Inventory of Other Social Effects

Because portions of the project area are located in Mercer and Monroe counties, WV, and Giles County, Virginia, it is important to also consider potential cultural and socioeconomic impacts to these counties resulting from current DSA (Phases 3 and 4) and future TSP construction at the dam. These counties comprise rural and sparsely populated areas, although Princeton in Mercer County is more developed and offers hotels, shopping, and restaurants. Like Summers County, these counties also enjoy beautiful landscapes and water resources as well as easy access to upstream and downstream reaches of Bluestone Lake, wildlife management areas, and parks. The communities pride themselves on giving their residents a safe community where families can live and work. As with Summers County, these counties have suffered in recent years from declines in coal and rail activities.

4.17.2.2.1 Mercer, Monroe County, WV and Giles County, Virginia - Socioeconomic Data

Table 4-21 displays population statistics from 2015 U.S. Census data for Mercer, Monroe, and Giles Counties. Table 4-22 includes the 2015 U.S. Census data on age, sex, education, housing, income, and employment for the counties. Mercer County has experienced the most change during the past few decades with nearly a 20 percent loss to its population since 1950. Monroe County's population has remained stable since the 1940s because most of its residents were employed in industries other than coal production and transportation. Giles County has also maintained a relatively consistent population since the 1960s.

Table 4-21. Mercer, Monroe, Giles Counties Population Statistics

Subject	Mercer County, WV	Monroe County, WV	Giles County, VA
Population			
Population estimates, July 1, 2015, (V2015)	61,164	13,506	16,708
Population estimates, July 1, 2014, (V2014)	61,785	13,582	16,815
Population estimates base, April 1, 2010, (V2015)	62,267	13,500	17,286
Population estimates base, April 1, 2010, (V2014)	62,266	13,500	17,286
Population, percent change - April 1, 2010 (estimates base) to July 1, 2015, (V2015)	-1.8		-3.3
Population, percent change - April 1, 2010 (estimates base) to July 1, 2014, (V2014)	-0.8	0.6	-2.7
Population, Census, April 1, 2010	62,264	13,502	17,286
Population, Census, 2000	62,980	14,583	16,657
Age and Sex Percent of Population			
Persons under 5 years, percent, July 1, 2014, (V2014)	6.4	5.4	5.1
Persons under 5 years, percent, April 1, 2010	5.7	5.6	5.3
Persons under 5 years, percent, 2000	5.8	5.0	5.7
Persons under 18 years, percent, July 1, 2014, (V2014)	21.0	20.9	20.7
Persons under 18 years, percent, April 1, 2010	20.5	21.0	21.7
Persons under 18 years, percent, 2000	21.1	20.1	22.0
Persons 65 years and over, percent, July 1, 2014, (V2014)	19.3	22.4	20
Persons 65 years and over, percent, April 1, 2010	18.0	19.6	18
Persons 65 years and over, percent, 2000	17.4	15.4	16.7
Female persons, percent, July 1, 2014, (V2014)	52.1	50.6	50.8
Female persons, percent, April 1, 2010	52.2	50.5	51.0
Female persons, percent, 2000	52.3	55.6	51.1

Sources: U.S. Census Bureau 2015b; U.S. Census Bureau 2015c; U.S. Census Bureau 2015d; U.S. Census Bureau 2000b; U.S. Census Bureau 2000c; U.S. Census Bureau 2000d.

Table 4-22. Mercer, Monroe, Giles Counties Housing, Education, and Employment Statistics

Subject	Mercer County, WV	Monroe County, WV	Giles County, VA
Housing			
Housing units, July 1, 2015, (V2015)	29,787	7,562	8,327
Housing units, April 1, 2010	30,115	7,601	8,319
Families and Living Arrangements			
Households, 2010-2014	25,590	5,719	7,253
Persons per household, 2010-2014	2.38	2.35	2.33

Subject	Mercer County, WV	Monroe County, WV	Giles County, VA
Education			
High school graduate or higher, percent of persons age 25 years+, 2010-2014	82.0	81.0	83.1
Bachelor's degree or higher, percent of persons age 25 years+, 2010-2014	19.0	13.8	17
Economy			
In civilian labor force, total, percent of population age 16 years+, 2010-2014	49.2	52.4	56.8
Income and Poverty			
Median household income (in 2014 dollars), 2010-2014	35,678	38,239	45,919
Per capita income in past 12 months (in 2014 dollars), 2010-2014	20,833	20,041	24,485
Persons in poverty, percent	20.5	19.3	13.5
Businesses			
Total employer establishments, 2014	1,261	172	287
Total employment, 2014	17,873	1,356	3,669
Total employment, percent change, 2013-2014	-3.7	-4.3	-0.1
Total nonemployer establishments, 2013	2,968	797	849
All firms, 2012	4,005	1,079	1,177

Sources: U.S. Census Bureau 2015b; U.S. Census Bureau 2015c; U.S. Census Bureau 2015d.

4.17.2.2.2 Mercer, Monroe, and Giles County Overview

Mercer is the most populous of the three counties within the project area and is located on the west side of Bluestone Lake. Project area portions of the Bluestone Wildlife Management Area are located in Mercer County; however, this area does not include developed campsites or boat access. The county offers cultural festivals, a vibrant art scene, numerous recreational opportunities, and two institutions of higher education in Concord University and Bluefield State College, and offers the project area's best lodging opportunities with more than 1,129 available hotel rooms (Princeton-Mercer County Chamber of Commerce 2016).

Princeton is the Mercer County seat and largest city near Bluestone Dam. Princeton grew significantly when it was Virginian Railway's headquarters and railroad cars were constructed there. In the late 1950s, Virginian Railway merged with Norfolk and Western Railway, which is the successor for the Norfolk Southern Railway. As the local rail industry transitioned from steam locomotives to diesel-electric locomotives, jobs and facilities were eliminated (Princeton Railroad Museum 2016). Princeton currently supports Concord University and its enrollment of nearly 3,000 and provides the retail and healthcare needs for the area (Concord University 2016). Mercer County has a county administrator and county commission made up of county commissioners with terms of six years. The City of Princeton has a city council made up of councilmembers, the mayor, and vice mayor.

Monroe County is rural and located to the east side of the project area. Project area portions of Bluestone Wildlife Management Area are located in Monroe County; however, this area does not include developed campsites or boat access. Monroe County's culture derives from the outdoors and agriculture and these traditions attract artisans and retirees (Monroe County 2016). Monroe County has a county commission made up of county commissioners with terms of six years. The City of Princeton has a city council made up of councilmembers, the mayor, and vice mayor.

Of the project area counties, Giles County, Virginia, is located farthest upstream, and project area lands located in the county include those maintained by Glen Lyn for RV campsites, a boat launch, and a nature trail. Among other events, these areas are used to host concerts, tractor pulls, cars shows, and a small festival, which support the local economy and promote the county's culture and community. Like Summers and Mercers counties, Giles County served the Virginia Railway and experienced subsequent population and economic declines. Giles County has a county administrator and a board of supervisors which hold bimonthly board meetings. The board of supervisors is made up of a chairman, vice chairman, and board members.

4.17.2.2.3 Mercer, Monroe, and Giles County - Recreation Inventory

Project area lands located within Mercer, Monroe, and Giles counties are relatively small and offer only limited access to the water resources provided by the project. However, these areas are still important to the three counties for fishing and hunting. Besides the lands in the vicinity of the Bluestone Dam, these counties offer their residents additional recreation opportunities which are important to the culture of their communities.

Parks and recreational facilities in Mercer County include Bent Mountain Legend Zip Line, Princeton Elks Country Club, Pipestem Resort State Park, Bluefield Golf Links, Princeton Parks and Recreation Area, Hatfields and McCoy Trail, Brush Creek Preserve and Falls, East River Mountain Overlook, Camp Creek State Park and Forest, Lotito City Park, and Reel Catch (Visit Mercer County 2016).

Monroe County, less populated and with fewer recreational facilities, has one additional park, Moncove Lake State Park, which is operated by WV State Parks (WVDNR 2016).

In addition to Glen Lyn Park, Giles County attractions include Virginia's Mountain Playground, Town of Narrows Park, and Mill Creek Nature Park.

4.17.2.2.4 Mercer, Monroe, and Giles County Organizations

Like Summers County, religion constitutes an important part of the culture of Mercer, Monroe, and Giles Counties, which host 124, 65, and 40 churches, respectively. Important organizations also include the historic societies in each county.

The Mercer County Historic Society is a non-profit charitable organization whose purpose is to study and preserve the history of Mercer County. It accomplishes this by collecting artifacts and maintaining a museum, buying actual historic real estate, producing annual historic events and providing educational resources (Mercer County Historical Society 2016). The Princeton-Mercer County Chamber of Commerce promotes businesses and organizations which sponsor events including Shrimp Feast, an annual golf tournament, Princeton Autumnfest, annual Women’s Expo, and Christmas Parade

Monroe County Historical Society mission is to “to foster a deeper understanding and appreciation of Monroe County’s history, culture, and natural environment by all.” It accomplishes this by offering tours of historic buildings and hosting a summer youth camp (Monroe County Historical Society 2016).

The County Historical Society mission offers a repository for Giles County histories, provides historical facts to area youth, and pursues and preserves Giles County artifacts, sites, and records (Giles County Historical Society 2016). The Giles County Chamber of Commerce lists many local businesses and provides opportunities and sponsor events to enhance the quality of life and sustain the local economy including community and farmers markets, fundraising carnival, and displaying a collection of local students are work.

5.0 ENVIRONMENTAL CONSEQUENCES

5.0 ENVIRONMENTAL CONSEQUENCES

This section describes the expected beneficial and adverse effects of each alternative on the significant resources previously discussed in Section 4.0 and serves as the source of information for Table 3-3, Comparative Impacts of Alternatives, presented in Section 3.0. Wherever possible, quantitative impacts have been assessed.

An impact (consequence or effect) is defined as a modification to the human or natural environment that would result from the implementation of an action. The impacts can be either beneficial or adverse, and can be either directly related to the action or indirectly (secondary, indirect, or synergistic effects) caused by the action. The effects can be temporary (short-term), long lasting (long-term), or permanent. For the purposes of this SDEIS, temporary (short-term) effects are defined as those that would last one year or less. Long-term but non-permanent impacts are defined as those that would last more than one year but cease within one year of construction completion (estimated between eight to 10 years). Permanent impacts would require an irretrievable commitment of resources more than one year past construction completion.

Impacts can vary in degree or magnitude from a slightly noticeable change to a total change in the environment. The impacts presented in this SDEIS are based upon existing regulatory standards, scientific environmental knowledge, and/or best professional opinions of the authors of the SDEIS. The significance of the impacts on each resource will be described as significant, moderate, minimal (or minor), insignificant (or negligible), or no impact. Significant impacts are those effects that would result in substantial changes to the environment and should receive the greatest attention in the decision-making process. Significance of an impact is determined by an examination of the context and intensity of the impact as a result of federal action. (49 CFR Part 1508.27)

5.1 Botanical Resources

5.1.1 Alternative 1: TSP- Basin with Supercavitating Baffles

5.1.1.1 Direct Effects

Direct adverse impacts to botanical resources under Alternative 1 would fall into two primary categories: 1) vegetation clearing for construction downstream of the dam, and 2) prolonged inundation of vegetation upstream of the dam.

Although the construction work limits shown in Figure 3-6 extend approximately 5,000 feet upstream of the dam along the bank of the river, no riparian vegetation is expected to be cleared in this area. This upstream area would be utilized only for barge staging, which is not expected to have more than a short-term impact on riparian vegetation due to incidental damage to smaller saplings and shrubs along the bank. Along Route 20 upstream of the dam, a limited amount of roadside vegetation may be cleared in two areas to provide ample space for equipment staging. This negligible impact would be permanent.

On the left descending bank on the downstream side of the dam, up to approximately 0.2 acres of riparian vegetation would be cleared to construct the temporary cofferdam tie-in to the bank. The dominant tree species at this site are river birch, American sycamore, tree of heaven (*Ailanthus altissima*), black cherry, sugar maple, mulberry (*Morus rubra*), box elder, American elm, tulip tree, red bud, honey locust (*Gleditsia triacanthos*), slippery elm, and silk tree (*Albizia spp*.) (USFWS 2013). Although the cofferdam would be temporary, the associated clearing of vegetation would be a minimal impact.

If the existing access road from WV Route 20 to the existing fishing pier on the left descending bank is shifted toward WV Route 20 or widened to accommodate construction traffic, up to 0.5 acres of forested area could be cleared. A temporary spur road may be built from this access road to the river bank, within the area cleared to install the temporary cofferdam tie-in. Although the access road would be temporary, the vegetation clearing would be a minimal impact.

On the right descending bank of the downstream side of the dam, very limited riparian vegetation exists within the construction work limits consisting of river birch, American sycamore, eastern red cedar (*Juniperus virginiana*), and tree of heaven (USFWS 2013). If a concrete conveyance system is constructed to deliver concrete from the bank batch plant to the right side of the stilling basin, some of these trees could be removed or otherwise impacted. Although the concrete conveyance system would be a temporary installation during construction, the vegetation clearing would be a permanent minimal impact.

As described previously, outflow from the dam is regulated to maintain a “summer pool” upstream of the dam at elevation of 1,410 feet for recreation and fish and wildlife conservation beginning in April. In the fall, the pool is drawn down to the “winter pool” at an elevation of 1,406 feet to allow for additional flood control storage. At times, water upstream of the dam is held at a higher pool than normal for a given season to regulate downstream flows; this condition is referred to as out of pool. During construction of the TSP, the area upstream of the dam could experience out of pool conditions for approximately three times as many days, which is approximately 54 average annual days per year, as are usually seen in Bluestone Lake, and these out of pool conditions could reach higher elevations more frequently. The degree of short-term impact from this more frequent, prolonged and/or higher elevation inundation would depend on both the season in which such inundation occurs, and the characteristics of the species inundated, and could range from negligible for certain species to moderate for others.

Prolonged inundation during a plant’s dormant season would have less of an impact than prolonged inundation during the growing season, particularly for annual plants. Annual plants, as opposed to perennial plants, could be more heavily impacted as inundation could restrict germination that occurs only once in the plant's life cycle. Plants with fibrous root systems could be more heavily impacted than those with taproots, as waterlogged soil becomes anoxic during prolonged inundation, leading to oxygen stress and eventual root system elimination in shallower root systems (Nilsson and Berggren 2000). Herbaceous plants can realize greater impacts from inundation than trees and shrubs, particularly when excessive sediment is introduced (Lowe *et al.* 2010).

Trees such as black willow and red maple are common in the zone of inundation upstream of the dam, and are highly tolerant of prolonged flooding. Trees such as boxelder, sycamore, and American elm, also common in the area, are somewhat tolerant of flooding. These species are relatively well-adapted to waterlogged soil and other stressors associated with inundation, and would not be expected to be heavily impacted by the more frequent, more prolonged or higher elevation inundation. Species such as white and red oak, sugar maple and tulip tree do not tolerate prolonged flooding (Iles and Gleason 2008); thus, increased duration, frequency and/or elevation of flooding could disproportionately impact these species.

Running buffalo clover is usually found within mesic woodlands, which would not likely be within the elevation range that normally experiences regular out of pool inundation upstream of the dam. Virginia spiraea is often found on rocky riverbanks which could be found within the zone of regular inundation (NatureServe 2016), as it relies on periodic disturbances such as high velocity scouring floods to eliminate competition from other plants and is well adapted to periodic flooding.

Of the rare plants tracked by the WVNHP, those species which are primarily found in floodplain openings, riverbanks and flat rocks within the zone of inundation would be at higher risk of prolonged inundation and its associated effects. These species include troublesome sedge (*Carex molesta*), star tickseed, and blue wild indigo (*Baptista australis*) among others. A full listing of the typical habitats of the rare plants known to occur within the project area is provided in Appendix B.

Direct long-term positive impacts to botanical resources under Alternative 1, as compared to the No Action Alternative, stem from the reduced risk of dam failure under this alternative. By reducing the risk of dam failure, downstream riparian vegetation would be at less risk of extreme scour events.

5.1.1.2 Indirect Effects

The increased duration of inundation upstream of the dam could lead to increased settling time for silt and sediment, which in turn could slightly increase the amount of sedimentation sustained by the vegetation communities within the zone of inundation. While trees and shrubs are more tolerant of sedimentation than herbaceous plants and groundcover, most species have a limited tolerance range for sediment addition on its root system. Thus, longer periods of inundation or increased frequency of inundation and thus cumulative sediment deposition could increase indirect mortality of species within the zone of inundation during construction. Additionally, if higher elevation areas are inundated, areas such as unimproved roads within area campgrounds could be submerged, causing increased erosion and thus sedimentation. While the indirect effect of increased settling time would be a short-term, the insignificant increased sedimentation could cause the long-term impact of individual plant mortality, though this impact is not expected to be significant.

5.1.1.3 Commitments and Mitigation Measures

In order to minimize impacts to botanical resources, clearing vegetation would only occur in previously which have been previously impacted and/or of lower quality. To mitigate for unavoidable impacts to botanical resources, river banks and slopes that are directly disturbed by construction activities will be revegetated with native trees and shrubs where practicable.

5.1.2 Alternative 2: No Action

5.1.2.1 Direct Effects

The No Action Alternative considers the longer than expected construction duration for the measures approved in the 1998 DSAS FEIS. However, no additional impacts to botanical resources were realized due to this extended construction period.

While the No Action alternative includes construction of Phase 3 and 4 risk reduction measures, which would reduce the risk of dam failure to an extent, the risk of dam failure under the No Action alternative still exceeds tolerable risk levels and therefore has a higher risk of dam failure than the TSP.

Dam failure would impact downstream aquatic, wetland and riparian species, as well as higher elevation vegetative communities that would not normally see flood stages. Impacts would include extreme scouring and destruction of plants and habitats, particularly plants with shallow root systems or those on loamy or sandy soils, or rocks.

Vegetation upstream of the dam would also experience impacts from dam failure, though not as extreme as downstream communities. Upon dam failure, the upstream pool would quickly be released, causing a sudden drop in water levels above the dam. This sudden drop could cause soil displacement and scouring, which could lead to direct and indirect plant mortality. Such impacts would be long-term and significant.

Although certain populations of non-rare species would be severely impacted or destroyed, such impact would not likely lead to extirpation of more common species. Rare species, however, would be at an increased risk of extirpation if they are found within the impact zone of pool inundation or downstream flood zone.

Because higher elevations would be impacted by severe flooding caused by dam failure, as water would be released from the upstream pool in an uncontrolled fashion, rare species known to occur at higher elevations could be put at higher risk of extirpation. Rare communities such as flat sandstone ledges found downstream of the dam would be at risk of destruction if the dam were to fail. While Virginia spiraea is adapted to periodic disturbance from flooding, USFWS notes that if the frequency and intensity of these floods is great, plants could be dislodged and transported to less desirable habitat or destroyed if extreme downstream flooding were to occur (USFWS 2014), making this species more vulnerable under the No Action alternative.

5.1.2.2 Indirect Effects

The severe habitat destruction and disturbance cause by dam failure and its subsequent extreme flood event could provide an avenue for rapid colonization by exotic species that are able to thrive in recently disturbed habitats (Diez *et al.* 2012).This impact would be further exacerbated by the loss of the native seedbank stored in the ground litter layer of the soil, which would be washed away and possible destroyed by fast-moving floodwaters, particularly in higher elevation areas which do not commonly have plants with flood-adapted seeds. This impact could be both long-term and significant.

If a dam failure were to occur, unrestricted flow would continue until such time that dam operations could resume or other means to control flow could be implemented. This prolonged period of unrestricted flow would allow additional erosion and scour during future flood events. This impact could be both long-term and significant.

5.2 Zoological/Wildlife Resources

This section describes direct and indirect impacts to on zoological/wildlife resources which could occur under the TSP and the No Action alternative, noting impacts to Federally-listed threatened and endangered species, USFWS species of concern, and State-listed rare species.

5.2.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.2.1.1 Direct Effects

Direct adverse impacts to zoological resources under Alternative 1 would fall into three primary categories: 1) noise disturbance during construction; 2) loss of vegetation within the construction limits, and 3) prolonged inundation of habitats upstream of the dam.

During construction, construction equipment and traffic would produce noise that could disturb wildlife species in the immediate vicinity of the dam. However, this is not a changed condition within the vicinity of the dam, as construction of the 1998 DSA features has been ongoing for a large portion of the last 16 years (construction began in 2000). Therefore, this disturbance is not a new impact caused by the TSP. Species that would have been driven from the area during construction of the TSP likely have already dispersed to other, nearby habitat during current construction activities. Bird nesting in the area immediately surrounding the dam has probably decreased due to ongoing construction, and this decreased nesting would likely persist throughout the construction of the TSP. This impact would be moderate, long-term, but non-permanent.

Limited vegetation clearing on the left descending bank on the downstream side of the dam would take place for construction of the temporary cofferdam and access road, causing a minimal, permanent reduction (approximately 0.7 acres) of riparian habitat for wildlife given the quantity of high quality riparian and forested habitat elsewhere within the project area.

The only Bird of Conservation Concern species that the USFWS believes would occur in the area immediately downstream of the dam, where the noise disturbance and vegetation clearing would take place, are the black-capped chickadee, bald eagle, and peregrine falcon. The closest bald eagle nests are near the Route 20 bridge crossing on the Bluestone River (over two miles from the dam) and on Brooks Island (approximately six miles from the dam), which are outside the range of noise disturbance from construction. The noise associated with the ongoing construction at the dam has not appeared to impact bald eagles foraging in the area, as USFWS cites year-round eagle foraging in this area (USFWS 2014) and bald eagles are known to be tolerant of human activity when feeding (Cornell University 2015); thus, the continued noise from construction of the TSP would not be expected to adversely impact bald eagles, despite the fact that construction has lasted 11 more years than originally disclosed in the 1998 DSA FEIS and is estimated to continue through 2026, with the majority of the major construction completed in 2019. Furthermore, the noise associated with construction is and would continue to be restricted to a small radius surrounding the dam, and individual eagles, peregrine falcons, and black-capped chickadee (*Poecile atricapillus*) would have foraging opportunities not impacted by construction activities within a short distance of the dam. Likewise, as the Federally-listed bats and WVDNR-tracked rare bat species within the project area are likely already avoiding the area in the immediate vicinity of the dam for roosting, and no hibernacula habitat (caves and mines) exists in the immediate area, significant impacts are not anticipated to bat species from the continued construction noise in the area.

Given the ongoing disturbances associated with the current construction on the dam, and the fact that the Bluestone Dam does not currently fall within any federally listed bat habitat buffers (USFWS personal communication), it is unlikely that any rare riparian bird species such as black-capped chickadees or Acadian flycatchers nest or bat species roost within the riparian vegetation that would be cleared for construction of the TSP. Peregrine falcons do not nest in trees, and bald eagles do not typically nest in the types of trees found within the habitat to be cleared for construction. Nonetheless, seasonal restrictions would be followed for tree clearing as described in

Section 5.2.1.3, which would reduce the risk of impacts to bird nesting by all birds, including Birds of Conservation Concern. Therefore, no significant impacts to avian species are expected from this vegetation removal.

Construction of the temporary cofferdam within aquatic habitat could cause direct mortality of aquatic species. Although USFWS has no records of the Eastern hellbender within the tailwater area, it nonetheless could exist. The cofferdam tie-in to the left descending bank would impact the riparian habitat in that area which could contain northern red salamander (*Pseudotriton ruber*).

While out of pool inundation of the upstream terrestrial habitats disrupts local populations of some terrestrial species, particularly riparian species, the extended time or increased elevation of such inundation would not necessarily increase this existing impact of inundation. Mobile species such as mammals including fox, mink, squirrel, bats and rabbit may migrate to other, non-inundated areas of habitat regardless of inundation duration or elevation. Smaller or less mobile species, such as terrestrial-stage adult red spotted newts or dusky salamanders, or eggs of species such as river cooters (*Pseudemys concinna*), could perish during the inundation, but would do so regardless of the period or frequency of inundation. Similarly, bat and bird species of concern would not experience greater impacts due to prolonged or more frequent inundation, though bat species could be impacted if inhabited caves become inundated. Thus, altered out-of-pool inundation upstream of the dam during construction of the TSP is not expected to increase the impact of the out-of-pool inundation currently experienced by zoological resources, with the exception of the increased risk of cave inundation which could impact bats.

5.2.1.2 Indirect Effects

Approximately 2.25 acres of aquatic habitat downstream of the stilling basin would be impacted by construction of the temporary cofferdam, impacting aquatic insects, crustaceans and macroinvertebrates within the tailwater of the dam. This construction would cause direct mortality of less mobile aquatic species, and indirect impacts associated with reduced tailwater flows when one half of the stilling basin is closed at a time during construction. This reduction in aquatic organisms would have a negligible long-term, but non-permanent, impact on food availability for certain terrestrial and riparian species such as salamanders and turtles which feed on such aquatic species.

5.2.1.3 Commitments and Mitigation Measures

Tree cutting will be minimized by clearing in previously disturbed areas and/or lower quality areas. Seasonal restrictions for tree clearing will be followed to prevent taking bird nests, eggs, and young (between September 1 and March 31, which is outside the nesting season for most native bird species). River banks and slopes that are directly disturbed by construction activities will be revegetated with native trees and shrubs, replacing lost habitat for terrestrial species where practicable.

Mitigation for impacts to aquatic habitat will be discussed in Section 5.3.

5.2.2 Alternative 2: No Action

5.2.2.1 Direct Effects

The No Action alternative considers the longer than expected construction duration for the measures approved in the 1998 DSAS FEIS. The 1998 FEIS stated that noise and construction traffic interrupting the nesting of birds and otherwise disturbing terrestrial species would be minimal and temporary; however, the subsequent extension of the construction period after the EIS was completed has led to a longer duration of disturbance of terrestrial and avian species, and is projected to continue through 2026, with the majority of the major construction completed in 2019. This extension of duration of disturbance may have led to the permanent relocation of individual or local populations of more mobile species, or could lead to relocation in the future.

While the No Action alternative includes construction of Phase 3 and 4 risk reduction measures, which would reduce the risk of dam failure to an extent, the risk of dam failure under the No Action alternative still exceeds tolerable risk levels and therefore has a higher risk of dam failure than the TSP.

Dam failure would impact downstream terrestrial species, as the uncontrolled flow of water would inundate and scour habitat, and likely cause direct mortality of individuals, including adults, juveniles, and eggs, depending on the species and season in which the dam occurs. Amphibian species such as green salamander (*Aneides aeneus*), whose habitat consists of rock crevices, would be more vulnerable to direct mortality from flooding than species such as the midland mud salamander, which spends most of its life cycle underground. Nesting sites for birds, including Birds of Conservation Concern, would be destroyed if trees were submerged or uprooted or cliff faces are impacted. Species which tend to nest at higher elevations, such as red-headed woodpecker (*Melanerpes erythrocephalus*), may experience less direct impact to nesting sites than species that tend to nest in riparian areas or on the ground, such as bank swallows (*Riparia riparia*) or worm-eating warbler (*Helmitheros vermivorum*). If emergent rocks were inundated or swept away, salamander nesting and dwelling habitat could be adversely impacted. If any open and abandoned mines were inundated, bat, woodrat (*Neotoma magister*) and cave salamander (*cave salamander*) habitat would be adversely impacted. Direct mortality impacts to individuals would be significant and permanent; impacts to habitat would also be significant, and could range from short or long term to permanent, depending on severity of the impact (inundation versus uprooting of habitat) and the recovery time of the habitat (regrowth of vegetation versus permanent loss of emergent rocks).

Terrestrial species upstream of the dam would also experience impacts from dam failure, though not as extreme as downstream communities. Upon dam failure, the upstream pool would quickly be released, causing a sudden drop in water levels above the dam. This sudden drop could cause direct mortality of smaller, less mobile species such as the river cooter, as such species could be pulled downstream with the floodwaters.

Although certain populations of non-rare species would be severely impacted or destroyed, such impact would not likely lead to extirpation of more common species. Rare species, however, would be at an increased risk of extirpation if they are found within the impact zone of pool inundation or downstream flood zone, particularly less mobile species. The habitat and nesting preferences of Birds of Conservation Concern and rare species are provided in Table 4-2 and Appendix C, respectively.

5.2.2.2 Indirect Effects

If a dam failure does occur, unrestricted flow would continue until such time that dam operations could resume or other means to control flow could be implemented. This prolonged period of unrestricted flow would allow additional erosion, scour and habitat disturbance/destruction during future flood events. This impact could be both long-term and significant.

5.3 Aquatic Resources

5.3.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.3.1.1 Direct Effects

Direct impacts to aquatic resources due to the TSP stem from the construction and use of the temporary cofferdam would be located no further than 105 feet downstream of the existing stilling weir. Although this cofferdam has been designed to minimize impacts to the downstream aquatic resources, the cofferdam footprint would unavoidably temporarily fill and dewater 2.25 acres of Resource Category 1 habitat. Direct mortality of aquatic macrophytes, benthic invertebrates, mussels, and crayfish would occur during the placement of the cofferdam and subsequent dewatering. Some of the species impacted could be state-listed imperiled species. No endangered species are expected within the tailwater area, so no direct impacts to these species are expected. Unique and irreplaceable habitat would be filled and dewatered for eight to ten years, causing a significant long-term, but non-permanent, reduction in riffle-run habitat in what is considered a highly productive aquatic zone. USACE will remove cofferdam material, restoring the aquatic environment to near baseline conditions allowing for reestablishment of fish habitat after construction completion, though full recovery of the local microhabitat and full species assemblages would occur over several years or even decades (Nilsson et. al. 2014).

If flow conditions during construction require the demobilization of the construction contractor to allow use of more than eight sluice gates at once, the timeframe of such demobilization may not allow total removal of all equipment and cleaning of all mechanical/hydraulic fluids and supplies within the cofferdam prior to flows being passed through the area. Though the probability of such a flow event and demobilization is low, the event could lead to release of pollutants or displacement of equipment and supplies into the downstream area.

During construction of the TSP, the USACE would implement erosion and sedimentation BMPs within the construction area to minimize downstream impacts from sedimentation. BMPs include, but are not limited to, the following: installation of sediment and erosion control devices (e.g., silt fences, filter socks, temporary sediment control basins, erosion control matting); adequate and continued maintenance of sediment and erosion control devices to insure their effectiveness; siting of equipment staging, fueling, and maintenance areas outside of wetlands, streams, and riparian areas to the maximum extent practicable; placement of cofferdam material below stilling weir during low or no flow to minimize material displacement; and preventing sediment, debris, and pollutants from entering the New River as much as possible. While BMPs would be implemented and strictly followed during construction, some minimal turbidity could be caused by construction of the cofferdam, which may lead to minor sedimentation affecting habitats downstream of the cofferdam. Should sedimentation occur it would have the greatest effect on benthic invertebrates and mussels, smothering those individuals on which the sediment settles and causing stress and/or direct mortality. Excess sediments fill spaces between gravels, cobbles and boulders that normally serve as habitat for macroinvertebrates and spawning fish (Stoddard 2006). Upon completion of construction, any displaced sediment would be expected to be moved downstream by future streamflow, particularly during flood events. Should sedimentation be realized during project construction, full recovery of the benthic assemblage in the downstream areas would be expected. Therefore, this impact would be considered minimal and long-term (duration of construction) but would not be permanent.

5.3.1.2 Indirect Effects

Prolonged inundation within Bluestone Lake during construction would lead to a longer settling time for suspended sediments within the lake, which could adversely impact benthic species within the lake. This impact is expected to be insignificant, as sedimentation is currently experienced within the lake. There could be increased sedimentation at higher elevations and further upstream within the lake, as the reduced use of sluice gates during construction could lead to higher elevation out of pool conditions at increased frequencies over the eight to ten-year construction period. If higher elevation areas that contain roads and other erodible surfaces such as the campground roads in Bertha are more frequently inundated, sedimentation could be greater than usual. This increased sedimentation and sedimentation in areas which would not normally see such frequent inundation or sedimentation would be a long-term impact during the period of construction.

The direct loss of prey species within the footprint of the temporary cofferdam could result in lower food abundance for fish species that normally inhabit the tailwater area. This could cause a moderate and long-term, but non-permanent, reduction in fish abundance in the tailwater area. In addition, minor clearing of riparian vegetation on the left descending bank for construction of the cofferdam tie-in also reduces a source of leaf litter and riparian cover, which could also indirectly impact food abundance for fish species.

Flow patterns within the tailwater area would be disrupted due to the closure and dewatering of one half of the stilling basin at a time during construction. In order to estimate the changes in flow conditions resulting from this construction technique, the USACE completed a 2-dimensional hydraulic modeling analysis encompassing the downstream area from the end sill of the second stage stilling basin to the confluence of the Greenbrier River, approximately 3,200 feet downstream. A range of flows (610 cfs to 60,000 cfs) were modeled for the right and left closure of the stilling basin.

Under current operating conditions, in which flow is released downstream evenly across the stilling weir, the area immediately downstream of the stilling weir experiences velocities ranging from 2 to 5 feet per second during flows ranging from 610 to 10,000 cfs, which is the most common flow range seen in most years. During flows ranging from 20,000 to 60,000 cfs, velocities downstream can reach as high as 9 feet per second.

Velocities would increase slightly at lower range flows during construction as compared to the current operating conditions due to the reduced weir length over which water would flow. For example, when the left cofferdam is in place, the tailwater area would be expected to start experiencing velocities of 6 feet per second or more during 10,000 cfs flows, whereas velocities would likely reach approximately 5 feet per second at that flow under normal conditions. The downstream area would be expected to start seeing velocities reaching 10 feet per second during 30,000 cfs flows during closure of the left cofferdam, whereas velocities would reach only approximately 9 feet per second during higher flows under current operating conditions. When the right cofferdam is in place, velocities would increase at lower flows than when the left cofferdam is in place; for example, velocities as high as 15 feet per second would be expected in some parts of the flow during extreme events (50,000 to 60,000 cfs) when the left cofferdam is closed, and at flows of 30,000 to 60,000 cfs when the right cofferdam is closed. These higher velocities, which could cause direct mortality of less mobile aquatic species or younger individuals of more mobile species, would be a slightly more common occurrence during construction of the TSP. The projected probability of the various flows through Bluestone Dam under normal operating conditions and the TSP are provided in Figure 5-1 and Figure 5-2, respectively. These figures show the probability that a flow is predicted to be exceeded in a given month. The lower the number in the left column labeled “Duration Exceedance,” the less likely it is that the flow in the columns to the right would be exceeded. Comparison of these two charts shows that higher flows would be slightly more common during construction due to the reduction in sluice gates used to pass flow.

Duration Exceedance	Flow (cfs)											
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0.1	55,871	36,855	50,910	52,975	35,898	44,573	31,886	36,046	40,032	32,500	45,216	36,259
0.2	52,771	36,075	48,890	51,539	34,146	42,944	29,872	30,820	38,909	31,526	43,054	31,768
0.5	46,086	33,619	46,362	45,555	31,680	33,970	25,030	23,661	34,499	24,877	36,404	28,786
1	39,889	31,574	42,958	38,874	29,108	28,771	19,141	16,815	31,101	20,199	28,555	23,869
2	32,733	27,526	37,669	33,872	25,624	22,127	11,759	10,971	21,317	14,543	21,428	20,032
5	21,531	21,197	28,642	24,447	17,137	13,873	6,869	6,493	7,981	9,273	11,926	14,651
10	14,600	16,038	19,685	16,729	12,661	9,689	5,065	4,630	4,945	6,089	8,432	10,796
15	11,338	12,343	15,673	12,915	10,094	7,831	4,380	3,845	3,704	4,489	6,899	8,466
20	9,485	10,584	13,184	10,773	8,692	6,621	3,972	3,390	3,168	3,686	5,832	6,925
30	7,155	8,630	9,950	8,898	7,299	5,330	3,499	2,869	2,448	2,798	4,566	5,244
40	5,966	7,047	8,376	7,608	6,386	4,308	3,131	2,538	2,146	2,231	3,560	4,027
50	4,912	5,476	7,276	6,608	5,673	3,785	2,837	2,177	1,968	1,908	2,778	3,399
60	3,944	4,402	6,207	5,758	5,034	3,342	2,526	1,981	1,759	1,626	2,187	2,940
70	3,143	3,674	5,034	4,958	4,434	2,893	2,298	1,754	1,529	1,481	1,874	2,364
80	2,434	3,023	4,137	4,131	3,793	2,272	2,027	1,444	1,408	1,360	1,599	1,858
85	2,137	2,671	3,507	3,676	3,264	2,116	1,856	1,350	1,309	1,246	1,549	1,679
90	1,893	2,297	2,975	3,278	2,788	1,801	1,658	1,154	1,193	1,183	1,481	1,561
95	1,535	1,927	2,295	2,746	2,427	1,627	1,430	1,017	1,060	1,054	1,326	1,451
98	1,336	1,682	1,998	2,246	1,851	1,357	924	902	910	833	1,222	1,302
99	1,169	1,579	1,756	2,045	1,788	1,216	767	847	845	803	1,202	1,166
99.5	754	1,481	1,626	1,614	1,521	1,071	748	836	836	797	1,086	1,109
99.8	659	1,402	1,336	1,187	1,347	1,053	742	764	823	610	944	847
99.9	610	1,341	1,173	610	1,324	900	727	745	800	610	810	610

Source: HE-ResSim Version 3.2 Dev, May 2013, Revision 3.2.0.1222, Build 2.1.10.3C.

Figure 5-1. Probability Exceedance of Various Flows through Bluestone Dam Under Normal Operating Conditions

Duration Exceedance	Flow (cfs)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.1	32,091	29,646	31,956	32,420	30,272	26,239	20,443	20,690	24,144	24,332	27,187	24,250
0.2	31,917	29,172	31,589	32,281	28,288	25,804	19,814	18,928	23,249	23,364	26,889	23,499
0.5	29,476	28,783	30,233	31,958	25,247	24,643	17,549	17,232	21,066	21,981	25,374	21,894
1	25,523	27,655	29,042	29,329	24,217	22,101	15,662	14,908	18,318	19,911	20,377	19,965
2	21,143	24,499	27,499	25,293	21,130	19,178	11,753	11,067	13,341	15,880	16,265	18,027
5	16,577	20,506	24,286	22,182	17,943	14,650	6,919	6,707	7,486	12,020	12,966	14,511
10	13,504	17,420	20,108	19,071	14,562	10,330	5,495	5,028	4,644	6,747	8,773	11,895
15	11,584	15,269	17,559	16,723	12,284	7,785	4,822	4,363	3,782	5,068	6,820	10,174
20	10,369	13,353	15,292	14,487	10,383	6,721	4,380	3,912	3,200	4,260	5,799	8,356
30	8,279	10,481	12,327	11,296	7,607	5,539	3,807	3,320	2,659	3,263	4,494	6,365
40	6,646	8,936	10,053	8,467	6,576	4,779	3,395	2,869	2,263	2,604	3,659	4,953
50	5,536	7,040	8,366	7,166	5,797	4,102	3,024	2,548	2,044	2,191	3,007	4,039
60	4,615	5,803	7,071	6,063	5,126	3,579	2,719	2,243	1,839	1,889	2,384	3,340
70	3,702	4,792	5,919	5,148	4,497	3,024	2,394	1,924	1,660	1,652	2,046	2,654
80	2,868	3,853	4,916	4,367	3,896	2,543	2,012	1,624	1,479	1,493	1,741	2,094
85	2,427	3,393	4,291	3,911	3,491	2,289	1,878	1,519	1,419	1,415	1,628	1,879
90	1,981	2,902	3,604	3,479	3,057	2,014	1,700	1,385	1,351	1,345	1,536	1,713
95	1,612	2,191	2,883	2,990	2,563	1,731	1,506	1,222	1,256	1,261	1,423	1,519
98	1,392	1,788	2,195	2,365	2,079	1,436	1,331	1,074	1,130	1,142	1,269	1,396
99	1,293	1,628	1,760	2,073	1,870	1,342	1,157	1,010	1,000	1,019	1,203	1,290
99.5	986	1,445	1,527	1,910	1,709	1,268	954	950	929	897	1,167	1,224
99.8	664	940	731	1,247	1,506	1,229	846	877	874	863	1,096	890
99.9	610	788	647	610	707	1,164	820	826	861	846	1,041	610

Source: HE-ResSim Version 3.2 Dev, May 2013, Revision 3.2.0.1222, Build 2.1.10.3C.

Figure 5-2. Probability Exceedance of Various Flows through Bluestone Dam During Construction of the TSP

The USACE hydraulic modeling also predicts that the tailwater area could see an increase in the areas experiencing dry conditions during the lowest flow through the dam during construction. Under current operating conditions, the banks of the in-stream island near the right descending bank experience drying at low flows ranging from 610 to 2,500 cfs. A slightly larger area around the island would experience drying when either side of the cofferdam is in place during construction during low flow conditions. The greatest drying impact is predicted when the right side cofferdam is in place, with drying patterns emerging not only around the island but also downstream of the cofferdam between the cofferdam and the island. Figure 5-3 shows the predicted changes in dry conditions during low flow events (610 cfs) under the existing conditions, with the right cofferdam in place and with the left cofferdam in place.

Approximately 62.5 acres of aquatic habitat could be impacted by the altered flow regime (USFWS 2014). This drying temporarily reduces available aquatic habitat in the tailwater area, including instream and riparian cover such as rock outcrops, boulders, and cobble/pebble riffles. The altered flow regime could lead to the loss of emergent water willow and could cause stress and/or mortality of benthic invertebrates, macrophytes and mussels, some of which could be state-listed rare species. This drying could also cause displacement of species that use the riffle microhabitats found in these areas, such as bigmouth chub (Lobb and Orth 1988). Fish could also be trapped in small pools and, in warmer months, suffer from increased temperature and depleted oxygen stress. The altered flows could alter water quality, turbidity, and total organic carbon or biological oxygen demand. However, if low flow periods can be limited to no more than 24 hours at a time, impacts to downstream aquatic habitat from such drying would not be significant. USACE will abide by this time constraint when possible, but may have to exceed 24 hours at times based on river conditions. The impacts due to the modified flow during construction would be significant and long-term, but non-permanent.

Upstream of the dam, alterations to the pool elevation, frequency and duration could have an insignificant adverse impact on fish spawning. Some species of fish lay eggs at the edge of the littoral zone, or at the lake’s edge. If a fish were to lay eggs during a period in which the lake is out of pool, those eggs could be exposed and dry out once the pool level returns to normal pool elevation. Because out of pool conditions are expected to be more frequent during construction of the TSP, there could be a higher likelihood that some fish eggs could be lost due to drying. However, this increase in likelihood is not expected to be significant.

5.3.1.3 Commitments and Mitigation Measures

In order to minimize the risk of introduction of invasive mussels into the New River, all construction boats would be decontaminated prior to use within the New River. The portion of the cofferdam to be built outside of the stilling weir would be constructed during low or no flow conditions, and would include impervious material on the west side, to minimize the risk of cofferdam material such as rock and gravel from moving into downstream aquatic habitat.

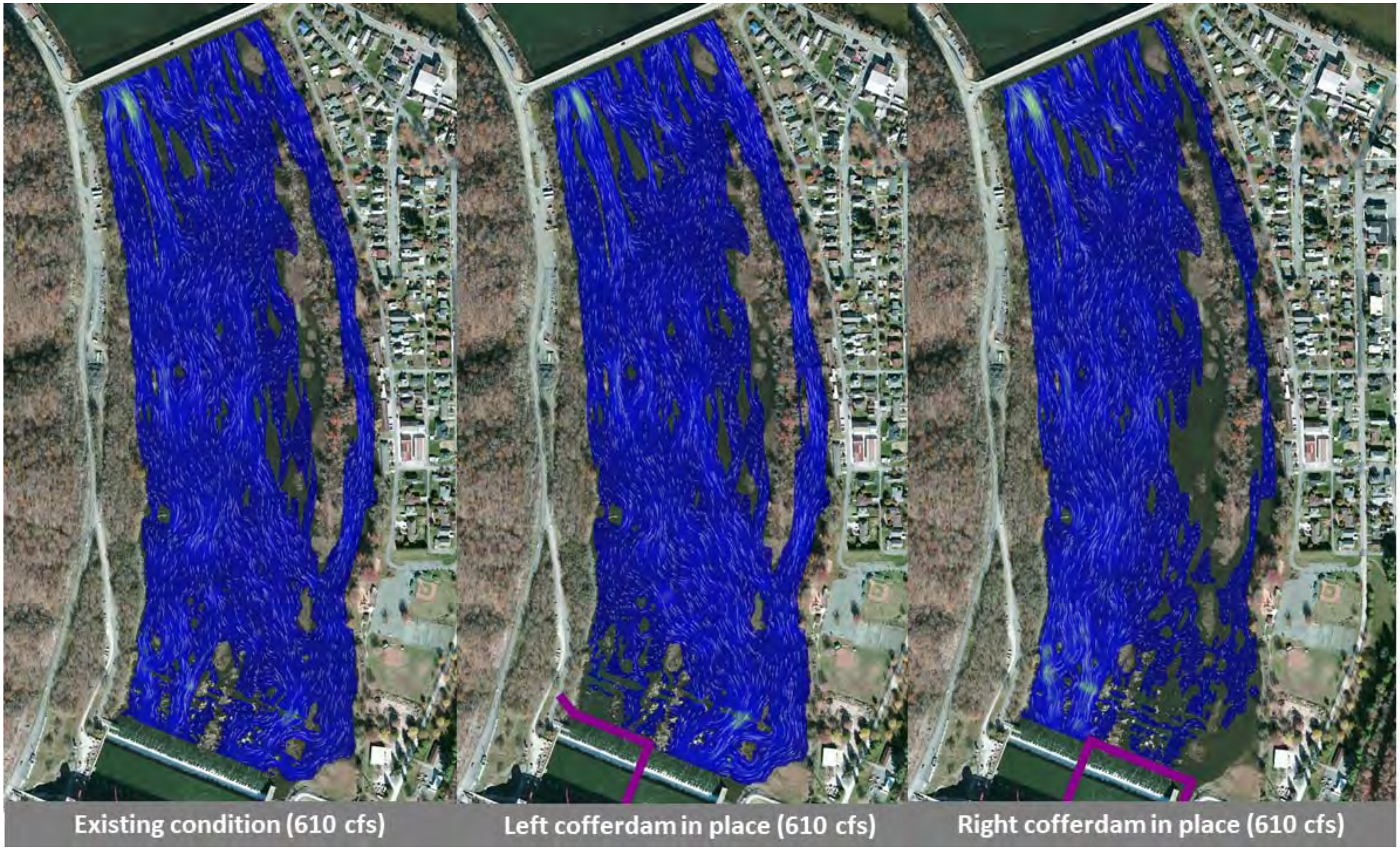


Figure 5-3. Tailwater Predicted Drying Under Low Flow Conditions Under Existing Conditions, Left Cofferdam and Right Cofferdam

The USFWS policy for Resource Category 1 habitat is to recommend avoidance of all impacts, but because alternatives are not available to avoid these impacts for the Bluestone Dam Safety project, the USFWS has decided to seek a net gain in conservation as an outcome on this project. USACE will restore the aquatic environment to baseline conditions and restoring disturbed fish habitat after construction completion and replant riparian vegetation. In addition to the impact minimization efforts described above, the USFWS (2014), using Habitat Evaluation Procedures, has recommended off-site mitigation for the 50.94 aquatic Habitat Units (HUs) impacted at a site, yet to be determined, that meets at least three of the following five criteria:

1. The site should be adjacent to the New River (river front property). The site can either have intact riparian buffers, and receive mitigation credit for preservation, or lack riparian buffers and receive credit for restoration.

2. The site should contain direct tributaries to the New River that are in need of restoration or enhancement. Restoration work can include, but is not limited to, livestock fencing, stream restoration work, enhancement of riparian buffer to reduce erosion (tree/shrub planting), and/or removal of barriers to fish passage.

3. The site should be significantly forested or have the potential to be replanted to improve riparian buffers.

4. There is the ability to secure the mineral and development rights for the site to ensure that it will not be developed in the future.

5. The site should be adjacent to another conservation area (e.g., Wildlife Management Area, State Park, or federally protected land).

Details of the mitigation recommendation are provided in Appendix H. The final mitigation plan will be developed in coordination with USFWS and would occur concurrent with construction of the TSP.

5.3.2 Alternative 2: No Action

5.3.2.1 Direct Effects

The prolonged construction duration for the 1998 DSAS project features may have led to increased impacts to aquatic resources by prolonging the period over which the impacts described in the 1998 FEIS occurred. For example, the EIS described disruptions to flow during certain portions of the anchor placement. This periodic disruption of flow, though limited to no more than 24 hours at a time, may have occurred more often than originally anticipated, causing a minimal and long-term, but non-permanent, impact.

Continued construction of Phases 3 and 4 and additional anchors would not cause the same direct impacts to the downstream Resource Category 1 habitat as the TSP, because no temporary cofferdam would be built and no further riparian vegetation would be cleared. Impacts would be limited to those described in the 1998 FEIS. However, aquatic resources would be at higher risk of significant impacts due to dam failure during the PMF under the No Action Alternative. If the dam were to fail, the high velocity flows would cause direct mortality of aquatic species, especially macroinvertebrates and juvenile life stages which have been shown to be particularly susceptible to high mortality during extreme floods in high-gradient systems (Hickey 1995). The high velocity water would scour the riverbed and banks, displacing important downstream habitat features such as riparian cover, woody debris, cobble and gravel bars.

Additionally, a large quantity of sediment which has settled within Bluestone Lake since the construction of Bluestone Dam would be washed downstream, adversely impacting benthic invertebrates and mussels, some of which could be state-listed rare species. These impacts to aquatic resources, including Resource Category 1 habitat, would be similar to but more severe and significant than the aquatic resource impacts seen during the New River Gorge floods of July 2001 (Mahan 2004). Endangered species believed to occur downstream of Gauley Bridge could be adversely impacted by such an extreme flood event. These impacts would be significant and long-term.

5.3.2.2 Indirect Effects

The loss of aquatic habitat caused by scour, erosion, and sedimentation would lead to an elimination of food sources for aquatic species, which would reduce species abundance and possibly diversity within the tailwater area as well as reaches further downstream. These impacts would be significant and long-term.

5.4 Wetland Resources

5.4.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.4.1.1 Direct Effects

No direct adverse impacts to wetland resources under the TSP are anticipated, with the exception of water willow which could be impacted by placement of the temporary cofferdam. As water willow is abundant within the New River, the few plants which would be directly impacted by the cofferdam placement amount to a minimal adverse impact.

5.4.1.2 Indirect Effects

Construction activities downstream of the dam could cause some additional sedimentation that would be deposited downstream in the water willow habitat, along the bank edges and upstream edges of islands. These impacts would be long-term but non-permanent and minimal since BMPs, as described in Section 4.3 Aquatic Resources, would be implemented to minimize the amount of sediment entering the stream as much as possible.

Upstream of the dam, the normal pools would be maintained at 1,410 feet elevation during the summer and 1,406 feet elevation during the winter. Under normal conditions, water elevations above the dam would exceed these normal pool levels for short periods of time to store excessive flood waters or to regulate downstream flows. During the construction of the TSP, these normal pool conditions would be expected to be exceeded approximately three times more often than usually experienced in Bluestone Lake. The increased water elevation, which would occur regardless of the TSP, could inundate the wetland areas along the banks of the lake and any islands that occur within the lake. The degree of short-term impact from this more frequent and/or prolonged inundation would depend on both the season in which such inundation occurs, and the characteristics of the wetland habitats being inundated. Since wetland vegetation is adapted to periods of inundation and flooding, impacts to these habitats could range from negligible to moderate depending on the type of habitat and floral species occurring within that habitat and the duration of the inundation. Inundation for short periods of an extra day or so should have an insignificant impact on the survival of the hydrophytic vegetation. However, if inundation is prolonged for several days or weeks, the hydrophytic vegetation could be affected and possibly killed, which could cause a moderate impact over the course of the entire construction period.

The increased duration of inundation upstream of the dam could slightly increase the amount of silt and sediment deposited within the wetland habitats occurring within the zone of inundation. Increased silt and sediments within the wetland habitats could cause long-term, minimal impacts to the wetland vegetation, depending on the vegetation type, species, and season. Small layers of sediments during the dormant season would have less impact on the wetland vegetation than during the growing season. However, deposition of a large amount of silt and sediment at any time, or in small increments over the course of the entire construction period, could moderately impact the wetland habitat by killing the vegetation.

5.4.1.3 Commitments and Mitigation Measures

No mitigation is proposed for wetland resources.

5.4.2 Alternative 2: No Action

5.4.2.1 Direct Effects

While the No Action alternative includes construction of Phase 3 and 4 risk reduction measures, which would reduce the risk of dam failure to an extent, the risk of dam failure under the No Action alternative still exceeds tolerable risk levels and therefore has a higher risk of dam failure than the TSP.

In the event of a dam failure, wetlands along the river banks, within the river channel, and any wetland habitats occurring upslope of the normal river stage would experience extreme scouring and the destruction of the habitat. These impacts would be long-term and significant. After the river returns to its pre-failure flow, some wetland habitats could reestablish over time; however, some locations may be permanently lost.

Upstream of the dam, the sudden release of the pool could cause severe erosion of the wetland habitats along the edges of the lake and islands, significantly impacting these habitats. Furthermore, the dam failure would remove the hydrology from wetland habitats associated with the lake allowing the vegetation to convert to a more upland community. Since the repair of this failure would take a significant amount of time, these impacts would be long-term and significant.

5.4.2.2 Indirect Effects

Flood waters from the dam failure would transport large amounts of debris and sediment downstream where it would settle out in river bends, mouths of tributaries, and upstream side of islands. Any wetland habitats located within these areas would also receive large amounts of sediment and debris, which would significantly impact those habitats permanently.

5.5 Floodplain Resources

5.5.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.5.1.1 Direct Effects

In accordance with E.O. 11988, the USACE has reviewed the potential impacts related to floodplain management for the TSP. As the Bluestone Dam is located in the floodplain, and modifications would be made to the dam as part of the TSP, there would necessarily be development within the floodplain; no practicable alternative to construction within the floodplain exists to address the dam safety deficiencies identified. No new areas within the floodplain would be permanently developed as part of the TSP.

The TSP would have no impact upon the frequency of the 100-year flood event downstream of the dam, as operation of the dam during construction and upon construction completion would allow for continued management of the Kanawha and New Rivers flow to maintain maximum flows at given control points, and development trends within the 100-year floodplain outside of the dam site would not likely change due to the TSP. Risk of catastrophic flooding due to dam failure during extreme events would be minimized under the TSP. The dam would continue to provide flood risk management reduce flood risks as authorized, however, residual risk of flooding under normal operating conditions would not change. During extreme flood events, inundation of floodplains throughout the project area and may impact areas beyond the 100-year floodplain. This effect would be a result of such events and not due to modifications to the dam under the TSP.

5.5.1.2 Indirect Effects

The TSP would have no indirect effects on floodplains. Modification of the Bluestone Dam would not alter the delineation of the 100-year floodplains within the project area. The 100-year floodplain has not been formally designated within the majority of Reconnaissance 1 upstream of the dam, and this is not expected to change regardless of the increased duration and elevation of out of pool inundation. According to FEMA and other sources of flood insurance, insurance requirements or rates would not be altered as a result of modifications to the dam (Appendix E).

5.5.1.3 Commitments and Mitigation Measures

Because adverse effects on floodplains are not expected as a result of implementing the TSP, no mitigation would be required.

5.5.2 Alternative 2: No Action

5.5.2.1 Direct Effects

As with the TSP, ongoing construction under the No Action Alternative would continue taking place within the floodplain. However, modifications are negligible despite the extended construction timeframe and limited to the dam site area, and are a requisite part of this functionally-dependent facility. During the PMF, floodwaters would inundate all 100-year floodplains, and perhaps more, as they would under the TSP. Risk of dam failure under the PMF is greater under the No Action Alternative, and catastrophic flooding due to dam failure would exceed the limits of flooding during the PMF under the TSP.

5.5.2.2 Indirect Effects

The No Action Alternative has no indirect effects on floodplain resources.

5.6 Water Resources

5.6.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.6.1.1 Direct Effects

A CWA Section 404(b)(1) analysis has been completed for the TSP, and is provided in Appendix I. Section 401 Water Quality Certification will be sought from the WVDEP during detailed design of the TSP.

During construction of the TSP, the USACE would implement erosion and sedimentation BMPs within the construction area to minimize downstream impacts from sedimentation. Possible BMPs are described in Section 5.3.1.1. While BMPs would be implemented and strictly followed during construction, some turbidity could be caused by construction of the cofferdam, which could lead to elevated suspended sediments in the water column. As part of the National Pollution Discharge Elimination System permit process, a General Stormwater Permit would be obtained prior to construction, which would include a site-specific Stormwater Pollution Prevention Plan (SWPPP) and Notice of Intent (NOI).

Placement of rock or sheetpile material on the riverbottom during construction of the cofferdam could re-suspend sediments, and these suspended sediments could settle out of the water column further downstream. This impact is expected to be minimal given the limited amount of sediment that would be expected to re-suspend, though any resulting sedimentation downstream would be long-term but not necessarily permanent.

To minimize the discharge of any sand or concrete fines into the water during concrete cutting, concrete removal, and anchor placement, cuts would be flushed with water and pumped to a lined settling basin on one of the downstream banks of the river, most likely the left descending side where an existing settling basin exists for Phase 3 and 4 construction. This would allow for most of the suspended solids in the construction wastewater to be removed prior to discharge back into the river downstream of the dam.

If flow conditions during construction require the demobilization of the construction contractor to allow use of more than eight sluice gates at once during a high flow event, the timeframe of such demobilization may not allow total removal of all equipment and cleaning of all mechanical/hydraulic fluids and supplies within the cofferdam prior to flows being passed through the area. Although the probability of such a flow event and demobilization is low, the event could lead to release of pollutants into the downstream area. Such a release could have a minimal to moderate short-term impact on water quality in the downstream area. Additionally, USACE contractors would be required to develop a site specific Spill Prevention, Control and Countermeasure Plan (SPCCP) prior to the start of construction, thus minimizing the threat of such a release, and a Facility Response Plan to prepare for a response to any release that might inadvertently occur.

On the upstream side of the dam, prolonged inundation within Bluestone Lake due to the eight sluice gate restriction on discharge during construction would lead to a longer settling time for suspended sediments upstream, leading to slightly higher rates of sedimentation within the lake. Although this potential effect would occur through the period of construction, this impact is not expected to be significant, as sedimentation is currently experienced within the lake. Out of pool inundation could cause increased sedimentation in areas further upstream or at higher elevations which do not normally see regular sedimentation, as the use of only half of the sluice gates would lead to higher out of pool conditions and/or higher frequency and increased duration. This would mean that the upper end of the pool may periodically be located further upstream and for longer periods than under normal operating conditions. The higher elevation erosion could also lead to inundation of more erodible areas such as agricultural fields or unimproved roadways and campsites, such as Bluestone State Park and Bluestone Camp and Retreat, which could increase sedimentation downstream within the lake. This increased sedimentation in areas which would not normally see such frequent sedimentation would be a minimal, long-term impact.

Because a SPCCP and Facility Response Plan would be implemented during construction, the risk to water quality in the project area is low. Therefore, the TSP and future operation of the dam would not be expected to impair any area surface waters such that they would no longer support their designated uses. Sanitary sewer facilities upstream of the dam would be at a higher risk of inundation during construction of the TSP, which could increase the likelihood of a pathogen release, such as *E. coli*, into floodwaters which would eventually wash downstream. However, these releases would be short term and occur during higher flow events rather than ongoing and small in scale given the limited development upstream, and thus would not be expected to impair surface waters or significantly increase the occurrence of fecal coliform in those reaches in Fayette and Mason County not currently fully supporting their designated uses. For the same reason, the TSP and future operation of the dam also would not impact groundwater resources within the project area.

5.6.1.2 Indirect Effects

No indirect impacts to surface water or groundwater resources within the project area are expected under the TSP, with the exception of the altered flow discussed in Section 5.3.1.2.

5.6.1.3 Commitments and Mitigation Measures

BMPs would be used in all facets of construction to minimize the introduction of contaminants or suspended solids into area surface waters. The portion of the cofferdam to be built outside of the stilling weir would be constructed during low or no flow conditions, and would include impervious material on the west side, to minimize the risk of cofferdam material such as rock and gravel from moving into downstream areas.

5.6.2 Alternative 2: No Action

5.6.2.1 Direct Effects

The prolonged construction duration for the 1998 DSAS project features likely did not increase impacts to water resources. Although the period of construction was prolonged, the amount of work that was completed over that time period was not increased. For example, the amount of concrete cutting and placement, and thus amount of concrete fines and sand that could have inadvertently been discharged into the river, did not change due to the increased construction duration. The area's waterways may have been at an increased risk of potential contamination by solvents, petrochemicals and other contaminants; however, BMPs were followed for the duration of construction and thus the risk of contamination was minimized.

Continued construction of Phases 3 and 4 and additional anchors would not cause any additional impacts to water resources outside those described in the 1998 FEIS. While there would be no impact to water resources during normal operation of the dam, water resources would be at higher risk of significant impacts due to dam failure during the PMF under the No Action Alternative. If the dam were to fail, the high velocity flows would cause significant scouring of both upstream and downstream habitats, leading to high levels of suspended sediments in the water column which would eventually settle out in areas not normally experiencing sedimentation. This would be a long-term and significant impact.

Flooding caused by dam failure would lead to decreased water quality, as areas inundated by the flood could include industrial sites containing chemicals and wastewater treatment plants. Released chemical contaminants would enter the water column and wash downstream, and some of the more persistent contaminants could settle into sediments, leading to long-term and significant water quality impacts.

5.6.2.2 Indirect Effects

In the event of an extreme flood due to dam failure, there would be no local sources of potable water for drinking or firefighting until treatment plants were reconstructed after floodwaters receded. Surface water quality degradation would continue after floodwaters receded, since wastewater treatment facilities would be inoperable following inundation. Until plants were reconstructed or repaired, sewage and other waste products would be discharged into surface waters without treatment. This would further exacerbate the current impairment of area surface waters by fecal coliform.

5.7 Air Quality Resources

5.7.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.7.1.1 Direct Effects

Several sources of air pollutants would contribute to the overall air impacts of the construction project, including:

- Emissions from transportation of construction materials such as cement, sand, aggregate, rocks, and sheet metal to the project site;
- Combustible emissions from the engines of construction equipment, workers' automobiles commuting to work, and trucks shipping miscellaneous supplies to the project site; and
- Fugitive dust (PM-10) when concrete is produced at the batch plant, during concrete cutting and drilling, and when soils are disturbed during earthmoving and excavation at the construction site.

Similar to ongoing construction, operation of an on-site batch plant to supply concrete for dam modification would be used. A grout mixing facility would also be present onsite to produce grout for anchors. Concrete is composed of water, cement, sand, and coarse aggregate. These materials (except water) would be delivered by truck to the site, and transferred to storage silos. In similar projects, materials are conveyed by gravity or screw conveyors to weigh hoppers, which combine the proper amount of each material in the concrete mix. After mixing, the concrete would be transported by pump or conveyor to the dam.

The following paragraphs describe the air calculation methodologies utilized to estimate air emissions produced by the TSP.

- <u>Air Emissions Associated with Transportation of Construction Materials, Commuter Vehicles, and Delivery Trucks</u>
  The USEPA Motor Vehicle Emission Simulator (MOVES) 2014a model is a state-of-the-science emission modeling system that estimates emissions for mobile sources for criteria pollutants, greenhouse gases, and air toxics (USEPA 2015). It is used to create emission factors or emission inventories for both onroad motor vehicles and nonroad equipment. MOVES 2014a was used to quantify the transport emissions from the large trucks used to transport material on public roads and highways and to generate emission factors for volatile organic hydrocarbon (VOC), CO, NO_x, exhaust PM, SO_2, ammonia, and CO_2. The model calculates emission rates under various conditions affecting in use emission levels (e.g., ambient temperatures, average traffic speeds).

This analysis addresses the air emissions from the heavy duty transportation of construction materials such as concrete, sand, coffer cells, anchors, and demolition material. Under the TSP, USACE estimates that 75,000 cubic yards of fill material and 100,000 cubic yards of concrete would be required at the construction site. In addition, USACE estimates that 250,000 cubic yards of material would need to be disposed of. Assuming 20 cubic yards per load, about 2,200 truckloads of cement, sand, and course aggregate for the concrete plant, 3,750 truckloads of fill material, and 12,500 truckloads of disposal material would be required during construction. Approximately 19,000 truck trips would be required during construction.

Construction workers and delivery trucks would temporarily increase the combustible emissions in the airshed during their commute to and from the project area. Emissions from construction worker commuters and delivery trucks traveling to the job site were calculated using the MOVES 2014a model.

- Air Emissions Associated with the Construction of the Dam Safety Modifications

Fugitive Dust Emissions: Fugitive dust emissions from general construction activities were calculated using the emission factor of 0.19 ton PM-10 per acre per month (Midwest Research Institute [MRI] 1996). Fugitive dust emissions from on-road activities were calculated using MOVES2014a.

Fugitive Dust emission factors for concrete batching were developed by USEPA and details on these emission factors can be found in the 1998 FEIS. It is estimated that concrete production rates would be 50 to 100 cubic yards per hour. This translates, for the TSP, to 4.5 tons per year of emissions, assuming total concrete requirements are 100,000 yd^3. Particulate matter, consisting primarily of cement dust, but also including aggregate and dust emissions, is the pollutant of concern. Emissions are fugitive, with the only point source being the transfer of cement material to the silo. Emissions can be controlled from the point source by venting to a fabric filter. Fugitive dust is largely a function of the surface moisture content of the materials, and can be controlled by water sprays, enclosures, hoods, curtains, and moveable chutes for storage areas. Due to emission rates and the proximity to the closest residences which are within one-third mile, the plant would be subject to review and possible regulation as a stationary source by the WVDEP Office of Air Quality.

Construction Equipment Emissions: MOVES 2014a was also used to calculate emissions from construction equipment, as recommended by USEPA (USEPA 2015). MOVES 2014a produces nonroad emission estimates that are equivalent to those from NONROAD2008, which was the previously USEPA nonroad emissions recommended model. Combustible emission calculations were made for standard construction equipment, such as front-end loaders, backhoes, bulldozers, and cement trucks. The construction equipment and trucks transporting materials to the site would be, and as such, would increase local levels of products of combustion including hydrocarbons, CO, and O_3.

The air quality emissions were calculated for construction activities to compare to the General Conformity Rule *de minimis* thresholds (100 tons per year) (USEPA 2016c). The annual air emissions from construction equipment, commuter vehicles, supply trucks, fugitive dust, and activities associated with transporting fill material, concrete material, and demolition material to the stockpile/landfill area due to the implementation of Alternative 1 are presented in Table 5-1. Details of the analyses are provided in Appendix J.

Table 5-1. Summary of Annual Air Emissions (tons/year) from Construction Equipment, Commuter Vehicles, Supply Trucks, Fugitive Dust, and Transportation of Materials for Alternative 1

Emission Source	Criteria Pollutants (tons per year)						Greenhouse Gases (tons per year)
	VOC	CO	NO_x	PM-10	PM-2.5	SO_2	CO_2 and CO_2 Equivalents
Combustion Emissions (off-road)	0.360	1.58	2.86	2.5	2.22	0.004	693.801
Fugitive Dust (construction site)	NA	NA	NA	20.52	2.05	NA	NA
Fugitive Dust (concrete plant)	NA	NA	NA	4.5	0.45	NA	NA
Construction Commuter & Trucking (on-road)	4.907	37.743	4.343	0.057	0.05	0.003	385.698
Total Air Emissions	**5.267**	**39.323**	**7.203**	**27.577**	**4.77**	**0.007**	**1,079.5**
De Minimis Threshold	100	100	100	100	100	100	25,000

* Note that Summers County is in attainment for all NAAQS (USEPA 2016b).

As mentioned above, the Bluestone Dam and all construction related to the dam modification is located in Summers County, which is in attainment for all NAAQS (USEPA 2016b). Therefore, the air emissions generated by construction of the dam safety modifications would not trigger a conformity determination even if they exceed *de minimis* levels, which they do not.

The air emissions from the construction of the dam safety modifications (TSP) would be long-term but non-permanent and would occur over an eight to ten-year period. The air emissions would cease once construction is complete. Increases in air pollution would occur from the use of construction equipment and heavy-duty trucks (combustion and GHG emissions) and the disturbance of soils, concrete production, and concrete cutting (fugitive dust) during construction of the proposed dam safety modification components. Construction workers would temporarily increase the combustion emissions in the airshed during their commute to and from the project area. Emissions from delivery/supply trucks would also contribute to the overall air emission budget. The highest levels of emissions would occur during the warmer months but would likely be dispersed by high winds. As there are no violations of air quality standards and no conflicts with the SIPs, the direct and indirect impacts on air quality from the implementation of Alternative 1 would be long-term, non-permanent, and moderate.

The GHGs emissions for dam modifications under Alternative 1 would be significantly less than the CEQ guidelines threshold of 27,557 tons, at which level agencies should consider further quantitative and qualitative assessment of GHG emissions (CEQ 2012). The implementation of the TSP would have a minor short-term impact on the regional GHG budget.

During normal operation, or during the PMF, Alternative 1 would have no impact on air quality since dam operation generates negligible NAAQS pollutants.

- <u>Summary of Anticipated Climate Change Impacts</u>
  The information included in this section is summarized from the Draft Bluestone Dam Safety Modification Study Future without Action Condition – Potential Future Effects of Climate Change in the Kanawha and New River Watershed (USACE 2016b), which is herein incorporated by reference. The synopsis can be found in Appendix F.

Climatologists have determined that climatic conditions during the period between 2011 and 2040 would closely resemble what has been experienced during the historic, or base, period between 1952 to 2001. There would likely be drought and flood events in the Kanawha and New River basin as have been seen during those base years, and those conditions wouldn't be more extreme (intensity or duration) than during the base years (1952-2001). However, after 2040, the Ohio River Forecast Center indicated that increases in mean annual air temperature and associated increases or decreases in precipitation throughout the New River and Kanawha River watersheds may make flood events and drought conditions more extreme. Forecasted increases in mean annual air temperatures at the Kanawha River gage would likely be 0.6^{o} F by 2020, 2.0^{o} F by 2040, 3.7^{o} F by 2050, 4.2^{o} F by 2070, and 7.6^{o} F by 2099.

Besides increasing temperatures throughout the four seasons (i.e., potentially more days exceeding 90^{o} F degrees in summer, warmer winter temperatures with more precipitation in the form of rain rather than snow and decreasing lake ice), increases in air temperature would begin to warm surface waters in Bluestone Lake, the New River, Claytor Lake, and tributaries to the New River during the 50-year period of analysis. A shift in aquatic species composition in lakes and rivers within the basin may occur as a result of warming surface waters. Aquatic species commonly associated with cool-water environments would likely migrate upstream into cooler headwater streams at higher elevations in the basin. Warm-water fishes would become the predominant species in the lakes. In addition, warmer water temperatures may encourage invasive aquatic species (macro-invertebrates, fishes, mussels, vegetation, etc.) to migrate into these previously cool-water habitats thus competing with indigenous species for resources and habitat.

The incidence and duration of algae blooms due to the combination of warmer water and ongoing introduction of nutrients and other pollutants into the lake from upstream locations (as a result of increased precipitation) could create water quality issues. Warmer air temperatures could result in a lengthened recreation season at the project area but unseasonably higher summer temperatures may also reduce day-use visitation during the hottest months. Warmer temperatures may also result in gradual shifts in vegetative species composition in the region and the introduction of invasive plants, insect pests, and diseases that could be detrimental to the forest community within the project.

The annual mean precipitation and resultant runoff and stream flows may increase by as much as 15 percent to 25 percent during the 50-year period of analysis. Much of this increase in annual mean flow may be due to increases in the fall (mean annual October flows expected to be 25 percent to 35 percent greater) rather than increases in the spring (mean annual March flows expected to be 5 percent to 15 percent greater). The higher spring flows could be problematic during operation of Bluestone Dam, recreation at Bluestone Lake, and for at-risk communities located along the New River and its major tributaries that contribute to readings at the Kanawha River gage. The increased frequency that critical elevations are reached or exceeded at the lake due to these forecasted changes could affect recreation usage and inundation-sensitive ecosystems bordering the lakeshore. Although forecasts of warming temperatures could lengthen the recreation season, higher incoming flows into Bluestone Lake could reduce usage of lakeside campgrounds and boat access points thus affecting visitation. Higher incoming flows could also increase erosion of riverbanks and the many islands present within the project area both in and upstream of the summer pool elevation. Both the sustainability of sensitive ecosystems and integrity of cultural resources sites existing along the river and on the islands could be at-risk from continued erosion due to these higher forecasted inflows. These additional environmental stressors could compound impacts occurring as a result of construction activities at the dam as well as future operational changes.

The environmental effects of forecasted climate change described above will not be effected by the TSP or No Action Plan. These changes will occur regardless of the Government's actions or inaction at Bluestone Dam. As the majority of the noticeable effects associated with forecasted climate change (temperature and stream flow changes) are anticipated to begin after 2040, the proposed action will be completed prior to that period.

5.7.1.2 Indirect Effects

Since the dam would operate under normal conditions once construction is complete, there would be no indirect effects to air quality.

5.7.1.3 Commitments and Mitigation Measures

During construction of the TSP, proper and routine maintenance of all vehicles and other construction equipment would be implemented to ensure that emissions are within the design standards of all construction equipment. Dust suppression methods should be implemented to minimize fugitive dust. In particular, wetting solutions would be applied to the construction area, including the concrete batch plant, to minimize the emissions of fugitive dust. In addition, maintenance of filters at the concrete plant would be followed and equipment and procedures to contain concrete dust generated during transfer and storage would be developed.

5.7.2 Alternative 2: No Action

5.7.2.1 Direct Effects

The impacts of ongoing construction that was authorized under the 1998 DSA Project (Phases 3 and 4) would be similar to Alternative 1. An additional 20 years of ongoing construction, has prolonged the air quality emissions (combustible and fugitive dust) within the immediate area of the dam. The impacts from the ongoing construction are expected to be long-term, non-permanent, and moderate. However, these impacts would cease once construction is complete.

Under Alternative 2, the impacts on air quality and climate change in the region would be similar to Alternative 1 during construction of the remaining DSA components which have not yet been completed. However, the length of time for construction would be less than Alternative 1 since the only construction activities would not be as extensive. There are negligible emissions related to the operation of Bluestone Dam during normal operations or in the event of the PMF.

5.7.2.2 Indirect Effects

Since the dam would operate under normal conditions once construction is complete, there would be no indirect effects to air quality.

5.8 Noise Quality Resources

USACE has determined that the Proposed Action or its alternatives would result in significant effects related to noise if the Proposed Action or an alternative would:

- Expose persons to or generate noise levels in excess of standards established;
- Expose persons to or generate excessive ground-borne vibration or ground-borne noise levels;
- Result in a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project (a substantial increase is defined by the USACE as an increase of 3 decibels or more); or
- Be located in the vicinity of a public airport, public use airport, or private airstrip, and expose people residing or working in the project area to excessive noise levels.

Noise in the construction area, either under the TSP or the No Action Alternative, would be generated by heavy equipment operation, concrete cutting, drilling, vehicular activity, material handling, and equipment loading and unloading. Noise levels would be a function of the types and numbers of pieces of equipment in use, the way the equipment is operated, and the specific environment in which equipment is used. The levels would be variable through the workday and through the project duration for up to eight to ten years for the TSP. It is assumed that equipment would be operating up to 10 hours per day and 5 days a week.

Table 5-2 presents noise emission levels for construction equipment expected to be used during the proposed construction activities. Anticipated sound levels at 50 feet from various types of construction equipment range from 74 dBA to 90 dBA, based on data from the Federal Highway Administration (FHWA) (2007).

Table 5-2. A-Weighted (dBA) Sound Levels of Typical Construction Equipment and Modeled Attenuation at Various Distances[1]

Noise Source	Distance from Source				
	50 feet	100 feet	200 feet	500 feet	1,000 feet
Auger Drill Rig	84	78	72	64	58
Backhoe	78	72	66	58	52
Bull dozer	82	76	70	62	56
Compactor (Ground)	80	74	68	60	54
Concrete Batch Plant	83	77	71	63	57
Concrete Mixing Truck	79	73	67	59	53
Concrete Pump Truck	81	75	69	61	55
Concrete Saw	90	84	78	70	64
Crane	81	75	69	61	55
Dump Truck	76	70	64	56	50
Excavator	81	75	69	61	55
Front-End Loader	79	73	67	59	53
Generator	81	75	69	61	55
Grader	85	79	73	65	59
Horizontal Boring Hydraulic Jack	82	76	70	62	56
Mounted Impact Hammer (Hoe Ram)	90	84	78	70	64
Rock Crusher	93	87	81	73	67
Rock Drill	81	75	69	61	55
Pneumatic Tools	85	79	73	65	59
Truck (Pickup)	75	69	63	55	49
Truck (Flat-bed)	74	68	62	54	48

[1]The dBA at 50 feet is a measured noise emission. The 100- to 1,000-foot results are modeled estimates.
Source: FHWA 2007; Bauer and Babich 2007.

The uses of concrete saws and hoe rams have a noise emission level of 90 dBA at 50 feet from the source and the rock crusher has a noise emission level of 93 dBA at 50 feet from the source. Assuming the worst case scenario, the noise model projected that noise levels of 90 dBA would have to travel approximately 900 feet before it would be attenuated to an acceptable level of 65 dBA. To achieve an attenuation of 90 dBA to a normally unacceptable level of 75 dBA, the distance from the noise source to the receptor would need to be approximately 280 feet. The noise level of 93 dBA would have to travel approximately 1,200 feet before it would be attenuated to an acceptable level of 64 dBA. To achieve an attenuation of 93 dBA to a normally unacceptable level of 75 dBA, the distance from the noise source to the receptor would need to be approximately 400 feet.

During Phase 3 construction, existing site-specific noise monitoring data was obtained by conducting a survey of the noise generated by the concrete batching operation. Noise readings were taken in the Bellepoint park area while the concrete plant and aggregate delivery system was both in operation and not in operation. The decibel levels near the batch plant while in operation ranged from 68 dBA (at batch plant control room) to 94 dBA (adjacent to re-screen shaker). With the concrete batch plant in operation, the decibel levels ranged from 61 to 63 dBA near the Bellepoint park parking lot entrance; 74 to 78 dBA at the basketball courts; 56 to 58 dBA at the first house on Riverside Drive; and 53 to 56 dBA at the first house on Miller Avenue. With the concrete batch plant not in operation, the decibel levels ranged from 54 to 57 dBA near the Bellepoint park parking lot entrance; 56 to 60 dBA at the basketball courts; 51 to 54 dBA at the first house on Riverside Drive; and 50 to 53 dBA at the first house on Miller Avenue (Shaka Inc. 2013).

5.8.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

In this discussion, direct and indirect impacts of noise generated during construction activities related to the TSP are assessed.

5.8.1.1 Direct Effects

Depending upon the number of construction hours and the number, type, and distribution of construction equipment being used, the noise levels near the project area could intermittently and temporarily exceed acceptable noise levels as defined by HUD and USEPA. The noise levels could exceed 75 dBA up to 400 feet from the project area and 65 dBA up to 1,200 feet from the project area. GIS technology was used to determine the number of sensitive noise receptors near the construction area. There are 16 receptors located within 400 feet of the project area, including Hinton Park, which could be impacted by construction noise levels of 75 dBA or greater. There are 33 receptors, including Hinton Park, within 1,200 feet that would be temporarily impacted by noise levels exceeding 65 dBA during construction activities.

The closest residence is located approximately 50 feet outside of the edge of the construction work limits and approximately 450 feet from the nearest construction area (concrete batch plant). The noise levels created by the concrete batch plant at the nearest residences were measured at levels less than 60 dBA (53 to 58 dBA). This is approximately a 4 dBA difference over noise levels when the batch plant is not in operation. The noise levels created by the concrete batch plant at the nearest public access area (basketball courts) were measured at 74 to 78 dBA. This is an approximate difference of 20 dBA over noise levels when the batch plant is not in operation. There are several areas near the concrete batch plant where considerable noise exposure is possible. At the areas immediately adjacent to the re-screen shaker, noise levels were measured between 90 to 94 dBA. The nearest regularly staffed work location is at the concrete lab where noise levels were measured at between 74 and 78 dBA.

The overall noise levels at the 33 receptors created by all the construction activities could exceed the USEPA-suggested residential noise level guidelines of no adverse impacts at 55 dBA and the HUD recommended acceptable level of noise exposure levels of construction activities in residential areas of 65 dBA. While the noise levels are not sufficient to cause damage to hearing or pose a health risk, these noise levels could adversely affect the quality of life for Bellepoint residents. The noise generated by the construction activities would be intermittent and last for approximately eight to ten years, after which noise levels would be expected to return to ambient levels. Moderate adverse impacts on the ambient noise environment, resulting from the construction of the TSP would be expected to be long-term, but non-permanent.

5.8.1.2 Indirect Effects

In addition to construction activities occurring within the construction work limits, noise would also be generated by truck traffic delivering materials to the site. For the TSP, it is estimated that 100,000 cubic yards of concrete and 75,000 cubic yards of fill material would be required at the site. Assuming 20 cubic yards per load, about 2,200 truckloads of material would be required for construction of the TSP. The proposed route to and from the construction area is likely to be Miller Avenue (within Bellepoint) to WV Route 3 to WV Route 107 or WV Route 20. This truck route would traverse local communities and is close to residential homes. Truck traffic (dump trucks, pickup trucks, and flatbed trucks) create noise that ranges from 74 to 76 dBA at 50 feet (FHWA 2007). Residences located 100 feet away from roads would have noise impacts of up to 70 dBA and residences located 200 feet away would have noise impacts up to 65 dBA. However, noise is reduced by about 10 dBA indoors with windows open, and 30 to 35 dBA with windows closed (USEPA 1974). The noise level from truck traffic would not damage hearing; however, the noise levels and traffic-induced vibrations could be an annoyance to some residents. Truck traffic delivering materials through Bellepoint and other residential areas would be limited to the hours of 9:00 a.m. to 2:00 p.m., Monday through Friday. The noise generated by the truck traffic during construction activities would be intermittent and last for approximately eight to ten years, after which noise levels would be expected to return to ambient levels.

Moderate adverse impacts on the ambient noise environment, resulting from the truck traffic during construction of the TSP would be expected to be long-term, but non-permanent.

5.8.1.3 Commitments and Mitigation Measures

There are several mitigation techniques and options to consider for reducing noise impacts. In general, physical noise barriers including vegetative barriers are not an effective measure to reduce construction noise on a routine basis. Construction noise may be controlled or reduced at its source before it is able to emit high noise levels by using quieter equipment (i.e., electrical internal combustion motors), maintaining equipment in good working order or using newer equipment, employing shields that are physically attached to a piece of stationary equipment, using sound aprons and dampeners, and muffling the internal combustion engines on the equipment.

Other techniques which could be used by contractors include: scheduling construction activities for times when there is a higher level of community noise already present and in such a fashion as to avoid quiet times; operating noisy equipment only when necessary and turning off equipment when not in use; and positioning noisy operations as far away from noise sensitive areas as possible. Work periods considered relatively noise tolerant, such as normal weekday working hours, would be defined. For this project, construction activities would be limited to daylight hours, to the extent practicable. Since noise created by truck traffic delivering materials to the site is of particular concern due to the proximity of houses to the route and the volume of traffic, truck traffic passing through residential areas would be limited to the hours of 9:00 a.m. to 2:00 p.m., Monday through Friday.

USACE would inform the community of planned construction activities on a routine basis, so that residents would know what to expect and can plan accordingly. Also, the USACE would institute a complaint mechanism and feedback to resolve issues of concern.

5.8.2 Alternative 2: No Action

5.8.2.1 Direct Effects

The impacts of ongoing construction that was authorized under the 1998 DSA Project (Phases 3 and 4) would be similar to Alternative 1. An additional 20 years of ongoing construction, has prolonged the elevated noise levels within the immediate area of the dam. The impacts from the ongoing construction are expected to be long-term, non-permanent, and moderate. Once construction is complete, noise levels would be expected to return to ambient levels.

Under Alternative 2 (No Action), impacts on the ambient noise environment are expected to be similar to those for Alternative 1; however, the construction for the No Action activities including the remaining DSA components is anticipated to be a shorter duration than construction of the TSP. There would be moderate adverse noise impacts from construction activities that would be considered long-term but non-permanent.

5.8.2.2 Indirect Effects

Similar to Alternative 1, noise impacts would occur due to continued increased truck traffic through local communities near the dam. Truck traffic delivering materials through Bellepoint and other residential areas would continue to be limited to the hours of 9:00 AM and 2:00 PM Monday through Friday. The noise generated by the truck traffic during construction activities would be intermittent. Once construction is complete, noise levels would be expected to return to ambient levels. Moderate adverse impacts on the ambient noise environment resulting from the truck traffic during construction of the No Action Alternative would be expected to be long-term, but non-permanent.

5.9 Geological Resources

5.9.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.9.1.1 Direct Effects

Construction of the TSP and normal operation of the dam would not impact geological resources. Additional anchors would be installed into the shale and sandstone, but the impacts would be negligible. However, during extreme flood events, surface geological structures could be impacted. Within the Appalachian Plateau and Ridge and Valley provinces, landslides are common events during heavy rainfall and flooding. Slope failure, debris avalanches, and landslide deposits would increase as a result of the catastrophic flooding and soil saturation, but would not be due to the dam alterations.

5.9.1.2 Indirect Effects

Under the TSP, a concrete apron would protect approximately 180 feet of natural riverbed. This action would prevent potential future erosion and scour downstream in the stilling basin.

5.9.1.3 Commitments and Mitigation Measures

No mitigation is required as there would be no impacts resulting from Alternative 1.

5.9.2 Alternative 2: No Action

5.9.2.1 Direct Effects

Under the No Action Alternative, construction Phases 3 and 4 would still be completed and additional anchors would be installed into the shale and sandstone. During extreme flood events, surface geological structures could be impacted. Within the Appalachian Plateau and Ridge and Valley provinces, landslides are common events during heavy rainfall and flooding. Slope failure, debris avalanches, and landslide deposits would increase as a result of the catastrophic flooding and soil saturation.

5.9.2.2 Indirect Effects

Under the No Action Alternative, continued erosion and scour downstream in the stilling basin could result in monolith instability and dam failure during extreme flood events.

5.10 Soil Resources

5.10.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.10.1.1 Direct Effects

Direct adverse impacts to soil resources under Alternative 1 would fall into two primary categories: 1) clearing of land for construction downstream of the dam, and 2) prolonged inundation upstream of the dam and displacement of soil.

Although the construction work limits extend approximately 5,000 feet upstream of the dam along the bank of the river, no clearing activities are expected in this area. This upstream area would be utilized only for barge staging, which is not expected to have more than a short-term impact on soils due to erosion of banks due to barge traffic. In order to provide additional space for equipment staging, a limited area along Route 20 upstream of the dam would be cleared along the roadside. This would have a negligible but permanent impact on soils.

Clearing would also occur on the left descending bank on the downstream side of the dam to construct the temporary cofferdam tie-in to the bank. Although the cofferdam would be temporary, the associated clearing would be a permanent minimal impact on soils.

If additional widening or shifting of the access road from WV 20 occurs, additional areas could be cleared. A temporary spur road may be built from this access road to the riverbank, within the area cleared to install the temporary cofferdam tie-in. Creation of the road would be a permanent minimal impact on soils.

As discussed previously (Section 3.4.3) , during construction of the TSP, the area upstream of the dam could experience out of pool conditions for approximately three times as many average annual days as usually seen on Bluestone Lake. This short-term impact could increase soil deposition and increase soil displacement in these areas.

Four types of soils are located within the construction work limits. Soils types and acreages impacted are shown in Table 5-3.

Table 5-3. Soil Types Impacted within Construction Work Limits

Soil Type	Prime Farmland?	Acreage within Construction Work Limits
Cateache-Berks channery silt loams, 30 to 70 percent slopes, very stony	Yes	48.51
Gilpin-Berks channery silt loams, warm, 35 to 70 percent slopes, severely eroded	Yes	3.63
Udorthents, smoothed	Yes	23.40
Kanawha fine sandy loam	Yes	17.68

Source: USDA 2016

Approximately 92.12 acres of soils designated as prime farmland soils are present within the construction work limits. Consultation with the NRCS for determination of impacts to prime farmland would be initiated prior to construction. A Farmland Conversion Impact Rating form (NRCS-CPA-106) would be completed and submitted to the NRCS for consideration, if necessary. However, due to the developed nature of the area, the implementation of the TSP would not have significant adverse impacts on prime farmland.

Direct long-term positive impacts to soil resources under Alternative 1, as compared to the No Action Alternative, stem from the reduced risk of dam failure under this alternative. By reducing the risk of dam failure, downstream soils would be at less risk of extreme scour events and erosion.

5.10.1.2 Indirect Effects

The increased duration of out of pool conditions upstream of the dam could lead to increased settling time for silt and sediment. The longer the period of, the more sediment would be deposited in those areas; however, the increase during construction of the TSP is expected to be insignificant. The cumulative sediment total from 1949 to 2007 was 12,019 acre-feet and the average annual rate of sedimentation was 208 acre-feet per year and 276 acre-feet per year for the last six years; however, this sedimentation has not had an impact on the flood control pool. Even if this average annual sedimentation rate were to double during construction of the TSP, which is a highly conservative estimate, no impacts to flood control pool storage are anticipated. Given the average rate of sedimentation of 276 acre-feet per year, and assuming that all the sediment load fills the area immediately adjacent to the sluice, it would take 27 years before impacts to the functioning of the sluice gates would be expected.

5.10.1.3 Commitments and Mitigation Measures

Construction impacts would be mitigated by using erosion and sediment controls such as staked hay bales, siltation fencing, earthen berms, sand bags, and other appropriate materials.

5.10.2 Alternative 2: No Action

5.10.2.1 Direct Effects

The No Action alternative considers the longer than expected construction duration for the measures approved in the 1998 DSAS FEIS. However, no additional impacts to soil resources were realized due to this extended construction period.

The risk of dam failure under the No Action alternative still exceeds tolerable risk levels and therefore has a higher risk of dam failure than the TSP. Dam failure would impact downstream soil resources that would not normally see flood stages. Impacts would include extreme soil displacement and scouring. Soil resources upstream of the dam would also experience impacts from dam failure, though not as extreme as downstream. Upon dam failure, the upstream pool would quickly be released, causing a sudden drop in water levels above the dam. This sudden drop could cause soil displacement and scouring.

5.10.2.2 Indirect Effects

If a dam failure were to occur, unrestricted flow would continue until such time that dam operations could resume or other means to control flow could be implemented. This prolonged period of unrestricted flow would allow additional erosion and scour during future flood events. This impact could be both long-term and significant.

5.11 Recreation Resources

5.11.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.11.1.1 Direct Effects

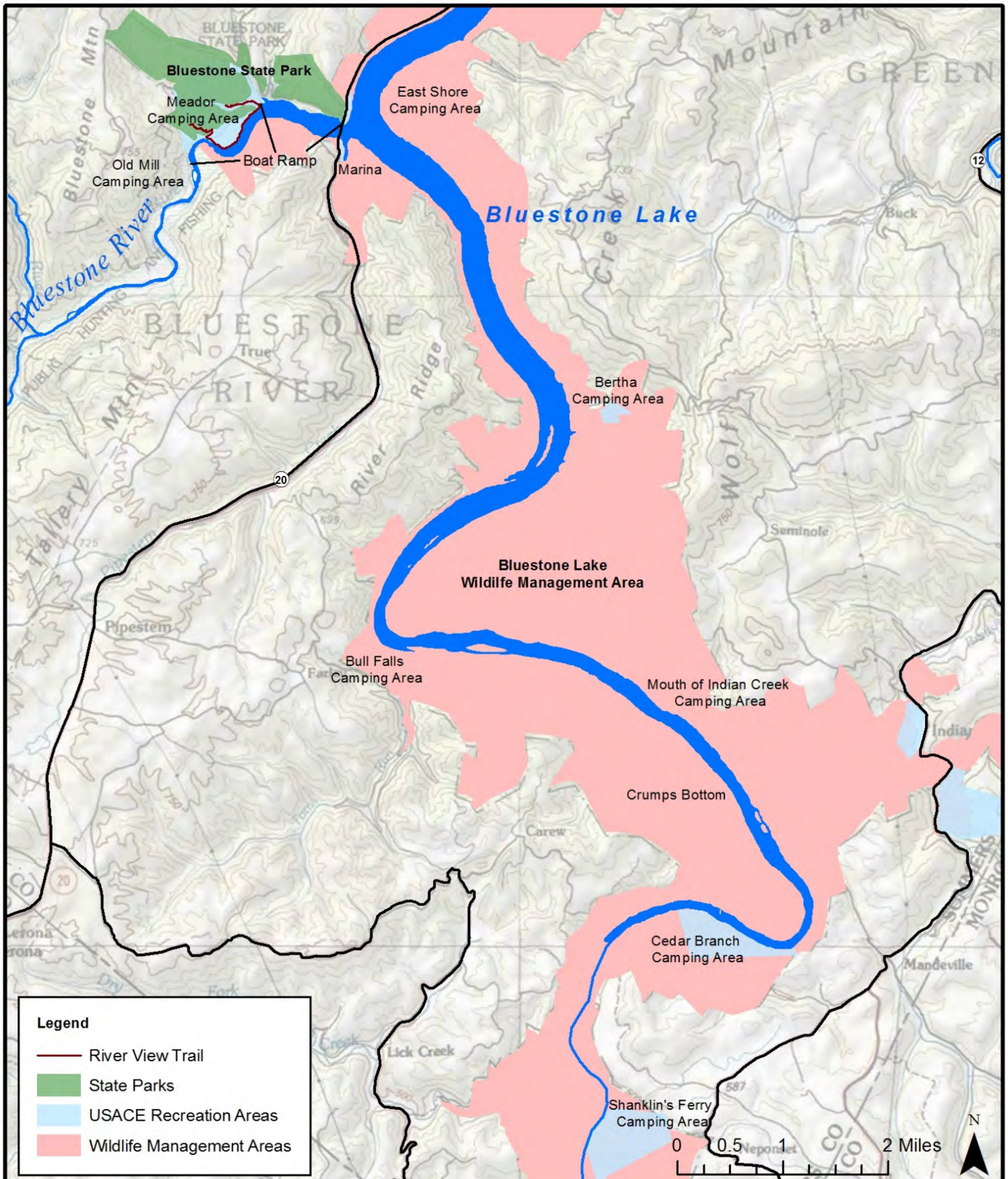
Moderate adverse effects to recreation resources may potentially occur upstream of Bluestone Dam during the construction of the TSP. As previously described (in Section 3.4.3), because the number of sluice gates available to drain Bluestone Lake would be reduced by half during construction of the TSP, the rate at which floodwater is transferred from the upstream side of the dam to the downstream side would be reduced. As a result, recreation facilities along the shoreline of Bluestone Lake may experience inundation periods of longer duration, and with higher water levels than that which is typically experienced during current conditions.

Upstream of the dam, the normal pools are generally maintained at 1,410 feet elevation during the summer and 1,406 feet elevation during the winter. Under normal conditions, water elevations above the dam would exceed these normal pool levels for short periods of time to store excessive flood waters or to regulate downstream flows. During the construction of the TSP, these normal pool conditions would be expected to be exceeded approximately three times more often than usually experienced in Bluestone Lake. The increased water elevation, which would occur regardless of the TSP, could inundate the recreational areas along the banks of the lake. The degree of short-term impact from this more frequent and/or prolonged inundation would depend on both the season in which such inundation occurs and the magnitude of the event.

Inundation of upstream areas occurs under current operating conditions of the dam, and inundation would occur during the TSP and after project completion, as the normal operation of Bluestone Dam includes the fluctuation of pool levels for flood control purposes. The relative probabilities of inundation under current operations, and during the TSP, are detailed in Section 3.4.3.

It is estimated that under current conditions, Bluestone Lake experiences eighteen days of out of pool conditions per year on average. The closure of sluice gates during construction may extend the period of out of pool conditions upstream of the dam by a factor of three, yielding a potential average annual inundation period of 54 days during construction of the TSP. Inundation mapping provides insight into the recreation facilities which could be impacted at various pool elevations.

Notable among potentially impacted recreation sites with the TSP and the No Action are facilities within Bluestone State Park (Figure 5-4). Meador Campground, Old Mill Campground, East Shore Campground, the park's boat ramps, marina, and Riverview Trail would be affected by rising water levels. The Meador camping area, with 32 sites open to RV or tent camping, would experience minor impacts at the 1,419-foot pool stage, with increasingly more severe impacts as pool stage elevations increase. At the 1,474-foot pool stage elevation, the entire camping area would be impacted, including the bathhouse and outdoor swimming pool. Old Mill campground's 44 campsites and central bathhouse would begin to be impacted at the 1,424-foot pool stage. At the 1,434-foot pool stage, the entire facility would likely be inaccessible. The East Shore Campground's 39 primitive, boat-only campsites would begin to be somewhat impacted by the 1,414-foot pool stage. When water levels reach the 1,419-foot pool stage, these sites would likely be unusable. Bluestone State Park's boat ramp near the office and gift shop could remain usable up to the 1,434-foot pool stage



Recreational Sites Impacted by Inundation

Bluestone Dam SEIS

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ECS - GEC JV

Figure: 5-4
Date: July 2016
Scale:1:80,000
Source: GEC/ESRI/USACE
Map ID: 0027.9701100.000

elevation, but would not be accessible at higher stages. The boat ramp at the confluence of the Bluestone River and Bluestone Lake (the “Pit”) would be unusable at the 1,414-foot pool stage and higher. The park’s marina would experience major impacts at the 1,414-foot pool stage, if not unusable, at this stage and higher. Portions of the Riverview Trail would be impacted at the 1,424- foot pool stage, and would be mostly submerged at the 1,434-foot pool stage.

Recreation facilities outside of Bluestone State Park which would likely be affected during construction of the TSP include several boat ramps upstream, all within the Bluestone WMA. The concrete, one-lane boat ramp at Bertha, approximately 3 miles upstream from the state park, may remain accessible up to the 1,434-foot pool stage. Additional east bank boat access (unpaved ramp) 1/3-mile upstream from Bertha would also be affected, likely becoming inaccessible at pool stages at or above 1,424 feet. A publicly-accessible boat ramp on the west bank of Bluestone Lake near Bull Falls Campground, approximately 3 miles south of the ramp at Bertha, would also be affected by rising pool stages. This concrete, one-lane ramp is likely usable at the 1,414-foot pool stage, but would be unusable at the 1,419-foot pool stage and higher. The small boat launch at the Mouth of Indian Creek may be usable up to the 1,424-foot pool stage; this ramp would be submerged and inaccessible at higher pool stage elevations. The small boat launch at Cedar Branch may be usable up to the 1,434-foot pool stage, but would be rendered unusable at higher pool stages. The small boat launch at Shanklin’s Ferry may be usable up to a relatively high pool level of 1,461 feet.

Several campgrounds in Bluestone WMA – Bertha, Bull Falls, Mouth of Indian Creek, Shanklin’s Ferry, and Cedar Branch – would also be affected by higher pool stage elevations. Both Bertha Campground and Bull Falls Campground upstream would become inundated at the 1,429-foot pool stage, with partial impacts beginning at the 1,419-foot pool stage. Mouth of Indian Creek Campground would become inundated at the 1,434-foot pool stage, with partial impacts beginning at the 1,429-foot pool stage. Further upstream at Cedar Branch Campground, impacts would begin to affect the camping area at the 1,434-foot pool stage, with inundation occurring at the 1,439-foot pool stage. Shanklin’s Ferry Campground would be significantly impacted at the 1,459-foot pool stage, yet portions would still be technically usable up to elevation 1,469 feet.

Certain hunting areas in Bluestone WMA upstream of the dam, such as Crump’s Bottom Hunting Area, would also be affected by rising pool stage elevations. Most of the Crump’s Bottom area lies below the 1,429-foot pool stage elevation; this large tract would be rendered off-limits to hunters at stages at or above this. Also, a percentage of Crump’s Bottom hunters likely make overnight stays at the nearby Bull Falls Campground, which, as previously stated, would also become inundated at the 1,429-foot pool stage elevation.

As discussed in Chapter 2, the Bluestone Dam was designed and built as part of comprehensive flood control plan and it provides to the local area and downstream communities significant benefits of public safety and health. The TSP is part of an on-going project to manage the risk of potential failure of the dam, which would have catastrophic health and safety effects on downstream communities, eliminate flood control capability, and cause the loss and destruction of natural, societal, recreational, and economic resources.

While upstream recreational areas would experience adverse effects associated with the increased frequency, duration, and magnitude of pool fluctuations, these effects are considered moderate, long-term, and non-permanent, particularly in light of the increased potential for dam failure in the no action condition which would have significant effects to recreational resources.

Over half the recreation visits to the immediate Bluestone area are concentrated at sites downstream of the dam. Effects on recreation facilities downstream from the Bluestone Dam under the TSP would be significant. The existing 12’ x 50’ cantilevered ADA-accessible fishing pier affixed to the left training wall would be removed in the early stages of the construction period. USACE is currently studying locations for alternative ADA-accessible fishing access downstream to offset the loss of the pier. Another popular fishing spot, the “catwalk” which runs parallel to the stilling weir, would be unusable during construction. However, access to the water below the dam outside of the CWL would still be available. The “beach” at the mouth of Pack’s Branch, just east of the dam’s right training wall, would be within the limits of construction and no access would be permitted during the construction period. Recreation further downstream could also be impacted. While changes in flow due to the TSP could possibly extend the whitewater rafting season due to lower discharges which would be beneficial, fisherman further downstream could experience negative impacts due to lower flow discharges.

Other recreation facilities in the immediate vicinity downstream of the dam include those at the Hinton City Park, including the boat slide, the baseball field not currently occupied by construction staging, and playground. These facilities should not be significantly impacted by dam releases up to 60,000 cfs, with either the left or right cofferdam in place (USACE 2016). The boat slide could be difficult to use during heavy flow events due to high water elevation, and with potentially dangerous currents and rapids in the channel. Construction noise and air impacts could reduce the aesthetic quality of these recreation sites for the duration of construction. Construction activities would result in a diminished capacity for the park to provide attractive and convenient recreation opportunities for local residents. These impacts would be moderate and long-term, though non-permanent.

5.11.1.2 Indirect Effects

Based on the above impacts, visitation numbers for Bluestone State Park and Bluestone Lake WMA could be negatively affected compared to current conditions, due to the reduced ability to pass water through the dam under the TSP scenario. This reduction in facility usability could impact the local recreation economy. The months from April through September are particularly important for the local tourism economy as illustrated earlier in Table 4-14. During this period, local residents and visitors are generally engaging in water-based recreation such as boating, fishing, and camping, when the pool elevation of Bluestone Lake is maintained at a higher elevation and temperatures are relatively warm. As previously stated, Bluestone Lake experiences eighteen days of flooding under current conditions and may experience 54 days of out of pool conditions on average during construction of the TSP. The potential impact of this extended period of high water is quite variable, depending on which time of year the flooding occurs. If high water occurs during the summer months, consequences could be severe since the forms of recreation people engage in during that period are negatively affected by higher water levels. If, however, flooding were to instead occur in late fall or winter, effects would be significantly less impactful to the recreation economy.

Because the recreation facilities upstream of the dam would be inaccessible and unusable more frequently over the eight to ten-year construction period. Visitors would seek alternate campground and boat launch facilities during those periods, overall visitor usage could decline in the long-term if visitors begin to more frequently use alternate facilities and establish new traditions of visitation elsewhere. This shift in usage could have a minimal long-term impact on the recreation economy.

The construction of the cofferdam or causeway including the direct impacts of the construction footprint would temporarily eliminate river access for the both the right and left descending banks within the downstream areas during the period of construction. This would include any access to the area commonly referred to as the catwalk. In addition, due to safety concerns for work areas with heavy equipment it is anticipated the public would be limited from accessing and recreating in locations near the cofferdam/causeway in addition to a safety buffer which is estimated to be 200 linear feet beyond the downstream side of the cofferdam or causeway. As stated above the ADA fishing pier on the left descending bank would be removed at the start of construction. Therefore, impacts to the recreational areas including decreased quality of fishing opportunities within the downstream reach are considered long-term, significant and non-permanent.

5.11.1.3 Commitments and Mitigation Measures

Due to significant impacts to the downstream recreational areas, including the loss of the existing ADA-accessible public fishing pier on the left descending bank, a new ADA-accessible fishing pier downstream of the dam would be constructed prior to the removal of the existing pier as part of the mitigation plan. USACE is also committed to replacing the existing ADA-accessible public fishing pier in the same general location when the TSP and DSA construction is complete. USACE will also consider additional opportunities upstream of the dam for access to the water. Recreation facilities in Hinton City Park will be restored to their pre-construction condition after construction is complete. The USACE is committed to active outreach to inform the public of when facilities would be unavailable as a measure to minimize adverse effects to recreation during construction. USACE would provide an enhanced communication plan to the recreational users. Methods would be developed in coordination with WVDNR and other recreation vendors to provide the most effective means for communication. Alternatives under consideration include, but are not limited to, additional signage reminding recreating public of lake pool fluctuations and information sources, enhanced website data, call-in number to receive current, and projected lake level information. USACE would also conduct outreach in order to inform potential Bluestone recreational visitors through media markets through the period of construction of current lake and river conditions.

5.11.2 Alternative 2: No Action

5.11.2.1 Direct Effects

The prolonged construction period for the 1998 DSAS features has led to a longer-term impact to recreation to Hinton City Park facilities than estimated in the 1998 FEIS. The prolonged closure of recreational fields used for construction staging has caused a shortage of available baseball and football practice fields, which has caused an overall reduction in youth sports activities for the surrounding communities. Continued noise and air quality impacts have led to long-term reduction in the aesthetic quality, serenity, and enjoyment of park facilities.

If a failure of Bluestone Dam occurred under the No Action Alternative, the catastrophic flooding could destroy downstream recreation facilities. Pool elevations upstream of the dam could not be maintained for recreation activities in the absence of the dam, likely reducing visitation of upstream recreation areas, particularly immediately upstream within the more heavily utilized portions of Bluestone Lake. Catastrophic flooding would cause damage to primary and secondary roadways used to access recreation and tourism destinations, popular river access sites, and numerous riverside recreation sites such as picnic and camping areas. However, Cedar Branch and Shanklins Ferry recreation sites would not be adversely impacted by the loss of the pool during a failure. These two sites could function with or without the pool as campsites for river fisherman and hunters.

5.11.2.2 Indirect Effects

If dam failure were to occur, the resulting mortality of aquatic species and habitat destruction would have a long-term and significant impact on fishing opportunities in the project area. The loss of the ability to maintain pool elevations for recreation upstream of the dam would further hinder the recreation economy that would be otherwise devastated by area flooding.

While recreation resources could be recovered following flooding, available funding could be limited, as it is typically first directed towards projects related to public health and safety. Experience from other flood events in WV has shown that recreation resources are slow to recover due to limited resources and the lower priority they receive.

5.12 Visual/Aesthetic Resources

5.12.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.12.1.1 Direct Effects

The TSP would have minimal impact on the overall visual character of the dam itself, but the construction of the divider wall through the middle of the stilling basin may preclude views of the entire dam from either bank. Whereas the entire stilling basin can currently be viewed from either bank, the divider wall would obscure such a view. This would be a long-term, permanent impact.

The TSP would have no visual impact on the upstream and downstream reaches of Reconnaissance Area 1 outside of the tailwater area. Within the tailwater area, the presence of construction equipment for eight to ten years would cause a continued visual disruption within the dam area. The interesting visual character of the water flow through the stilling basing and over the baffles would be disrupted by the construction of the temporary cofferdam and subsequent dewatering of half of the stilling basin. Although long-term and moderate, these impacts would be non-permanent, and the dam would be returned to its original visual character once construction is complete with the exception of the divider wall.

The removal of the tailwater fishing pier would eliminate this currently available opportunity for downstream landscape viewing for a long-term period. However, the downstream landscape viewshed itself would not be impacted, and numerous other opportunities exist for downstream landscape viewing within Reconnaissance Area 1, including a temporary fishing pier to be constructed as mitigation for the loss of the existing pier. Therefore, this impact is negligible.

5.12.1.2 Indirect Effects

The continued presence of construction-related traffic including commuting workers, materials delivery, heavy construction trucks, and equipment would detract from the aesthetic qualities and ambiance of Hinton, Bellepoint, and the surrounding area. Similarly, the continued use of adjacent lands for staging and concrete production limits the aesthetic enjoyment in what would otherwise be a relatively tranquil riverside recreation complex. This impact would be moderate and long-term, but would not be permanent.

5.12.1.3 Commitments and Mitigation Measures

Other than the temporary replacement of the tailwater fishing pier, which allows for continued viewing of the downstream landscape, no additional mitigation for the visual impact of the TSP is proposed.

5.12.2 Alternative 2: No Action

5.12.2.1 Direct Effects

Construction related visual impacts to the immediate dam area would continue under the No Action Alternative, as construction Phases 3 and 4 and other project features would continue. However, as opposed to the TSP, the existing opportunities for downstream landscape viewing from the tailwater fishing pier would not be impacted under the No Action Alternative.

Continued construction of Phases 3 and 4 would not have any impact on the downstream and upstream areas within Reconnaissance Area 1. However, without construction of the TSP, the dam would be at a higher risk of failure. Should dam failure occur, significant impacts to the distinct visual character of the downstream area within the New River Gorge National River could occur. Significant scouring, deposition of debris and sediment, and habitat destruction would occur, disrupting the largely undisturbed visual character of the gorge area.

5.12.2.2 Indirect Effects

The prolonged construction duration of the 1998 DSAS project features has led to a long-term disturbance in the overall aesthetic quality of the recreational areas in the immediate vicinity of the dam.

Under the No Action Alternative, the continued presence of construction-related traffic including commuting workers, materials delivery, heavy construction trucks, and equipment would continue to detract from the aesthetic qualities and ambiance of Hinton, Bellepoint and the surrounding area. Similarly, the continued use of adjacent lands for staging and concrete production limits the aesthetic enjoyment in what would otherwise be a relatively tranquil riverside recreation complex. This impact would be moderate and long-term, but would not be permanent.

5.13 Cultural Resources

The National Historic Preservation Act of 1966, Section 106, requires that USACE “take into account" how proposed modifications to the Bluestone Dam could affect cultural resources located in the impact zone. Coordination with the WV SHPO regarding Section 106 requirements has been ongoing and has resulted in the execution of a Memorandum of Agreement (MOA) in 2000. In this section, the impacts of the different plan alternatives on cultural resources are assessed. These impacts can have effects on previously recorded cultural resources. It is important to note that only resources in the APE were evaluated.

During the 1997 Phase I Investigation conducted by USACE, USGS quadrangle maps and county files containing location data for archeological sites and historic structures in or near the APE were examined (Appendix G). Site forms for prehistoric properties were reviewed, and National Register properties were reviewed and tabulated. SHPO has determined that no new archaeological sites have been found since the Phase I investigation was originally conducted.

5.13.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.13.1.1 Direct Effects

Implementation of the TSP would cause additional visual impacts from a cultural resource perspective to Bluestone Dam which has been deemed eligible for listing on the NRHP. While cultural resources are located within the APE, there are no recorded cultural resources located within the construction limits of the TSP.

Upstream of Bluestone Dam (Reconnaissance Area 1)
In the APE upstream of the Bluestone Dam, in Reconnaissance Area 1, there is a potential for adverse effects on archeological sites. During the implementation of the TSP, there is a possibility of a higher pool level upstream of the dam for longer periods of time than normal. Inundation levels, or pool stages, range from a low of 1,409 feet to a high of 1,519 feet. This could cause some sites at lower elevations to be inundated more often. Additionally, sites that are not usually inundated would be adversely impacted during higher, prolonged inundation. The adverse impacts would be due to physical erosion and siltation. Additionally, artifacts could possibly be displaced losing important contextual information. Consequently, information on the patterning of human activity over the landscape would be destroyed.

Downstream of Bluestone Dam (Reconnaissance Areas 1, 2, 3 and 4)
Implementation of the TSP would lessen the risk of catastrophic flooding downstream due to dam failure, thereby helping to protect the approximately 500 archeological sites and historic structures identified in that area.

There would be no significant adverse effects from the TSP to known or unknown archeological resources downstream of the Bluestone Dam in Reconnaissance Areas 2, 3, or 4. Additionally, an increase in the size of water controlling features (i.e. baffle blocks) would aid in diminishing erosion downstream of the dam. Any significant impacts to cultural resources would result from the PMF rather than from modifications made to the dam associated with the TSP.

5.13.1.2 Indirect Effects

Large open areas would be required as staging areas for the storage of heavy equipment and material for the improvements. Clearing of any additional areas for staging or construction outside of those previously considered for the 1998 DSAS construction could cause the disturbance of undiscovered resources, and require additional coordination, in accordance with Section 106.

Should any fill be required for construction of the TSP or the restoration of Hinton City Park to pre-construction condition, the source of the fill could have an indirect effect on cultural resources. Additionally, the TSP and previously completed modifications may stimulate development in the vicinity due to less risk of dam failure. Private commercial suppliers and developers may not be required to follow regulations designed for the identification and protection of cultural resources. As a result, additional cultural resources could be impacted during private development.

5.13.1.3 Commitments and Mitigation Measures

An MOA for the 1998 DSAS dam modifications has been executed between USACE, WVDCH, and the ACHP in 2000. This MOA would also be applicable to construction during the TSP. Any stipulations from the MOA not yet met will be completed. Further modifications to the original structures of the dam proposed in the TSP would require additional documentation as required by the MOA. Additionally, impacts to cultural resources can be minimized through the use of established or previously disturbed staging areas or borrow sites.

In accordance with 36 CFR 800.6(c), the MOA was prepared to evidence USACE's compliance with Section 106 and ensures USACE carries out the undertaking in accordance with the MOA. Per the MOA, if USACE discovers historic properties or archeological sites without prior planning or if unanticipated effects on historic properties or archeological sites are found after USACE has completed the Section 106 process, USACE will initiate coordination with the WVSHPO and consult with Tribes to make reasonable efforts to avoid, minimize, or mitigate adverse effects to such properties or sites pursuant to 36 CFR 800.13(b). If no construction has commenced, USACE will consult with WVSHPO and Tribes to resolve adverse effects pursuant to 36 CFR 800.6. If construction has commenced, USACE will determine actions to take to resolve adverse effects, and notify WVSHPO within 48 hours of discovery. The notification shall describe the actions proposed by USACE to resolve the adverse effects. WVSHPO shall respond within 48 hours of the notification and USACE shall take into account his/her recommendations and carry out appropriate actions. USACE will provide WVSHPO a report of the actions when they are completed pursuant to 36 CFR 800.13(b)3.

5.13.2 Alternative 2: No Action

5.13.2.1 Direct Effects

The No Action alternative considers the longer than expected construction duration for the measures approved in the 1998 DSAS FEIS. However, no additional impacts to cultural resources were realized due to this extended construction period.

There are no recorded cultural resources located within the construction limits of Phase 3 and 4; therefore, there would be no impacts on cultural resources associated with construction.

The No Action alternative exceeds tolerable risk levels and therefore has a higher risk of dam failure than the TSP. Upon dam failure, the upstream pool would quickly be released, causing a sudden drop in water levels above the dam resulting in potential impacts to downstream sites.

<u>Upstream of Bluestone Dam (Reconnaissance Area 1)</u>
There would be no inundation impacts associated with the No Action Alternative; and, therefore no adverse impacts to known or unknown archaeological or historical sites upstream.

<u>Downstream of Bluestone Dam (Reconnaissance Areas 1, 2, 3 and 4)</u>
A dam failure would increase the likelihood of inundation of the approximately 500 recorded archeological sites and historic structures identified downstream of the Bluestone Dam. Archaeological and historic sites immediately below the dam would be severely impacted. Artifacts displacement, erosion, and siltation would occur along with the destruction of important contextual information. Previously unrecorded cultural resources would also be similarly affected. The No Action alternative has the greatest significant adverse impacts on archaeological sites and structures downstream of the dam. The impacts would be considered long-term and permanent.

5.13.2.2 Indirect Effects

Should any fill be required in the remaining construction phases or the restoration of Hinton City Park to pre-construction condition, the source of the fill could have an indirect effect on cultural resources. Additionally, previously completed and remaining DSA modifications may still stimulate development in the vicinity. Private commercial suppliers and developers may not be required to follow regulations designed for the identification and protection of cultural resources. As a result, additional cultural resources could be impacted during private development.

5.14 Socioeconomic Resources

5.14.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.14.1.1 Direct Effects

The TSP does offer some positive long-term impacts to the local economy in the form of jobs in the construction industry, expenditures on construction materials and indirect spending in the local communities by construction workers on items such as food, gas, entertainment, and miscellaneous items. A potential negative impact would include a decrease in visitors to the lake and surrounding areas during construction. This would lead to a loss of revenue for local businesses.

No homes or businesses would be displaced with the implementation of the TSP. Property values in the immediate vicinity of construction activities could be adversely impacted in the short-term because of noise impacts and the traffic congestion caused by the construction. In the long term, property values would be expected to increase with the reduced risk of dam failure.

With the implementation of the TSP, impacts on community cohesion would be expected to be adverse or neutral. Elevated noise levels from construction and associated traffic would have minor adverse or neutral effects on community cohesion in the vicinity of the project area because individuals may not spend time outdoors interacting with others in their neighborhood due to the noise. In addition, the encroachment of the construction staging areas on Hinton Park would have adverse impacts on community cohesion. However, in the long-term, there would be beneficial permanent impacts on community cohesion through the reduced risk from a failure of Bluestone Dam afforded to the individuals in the area. Individuals' homes, businesses, churches, and community centers would be better protected, which would allow for maintained community cohesion.

Large quantities of material would be delivered to the construction site which could impact the transportation corridors throughout the project area. Construction easements and transport of construction equipment and materials would temporarily impede vehicle traffic and likely result in a minimal reduction of the level of service along major and local roadways. This would result in moderate, long-term but non-permanent impacts, including temporary road closures and congestion in those areas where construction would occur.

According to the projected 2015 Census (see Table 4-17), Giles County is approximately 3.5 percent minority, and 13.5 percent of the populations have incomes below the poverty level. Mercer County is approximately 8.8 percent minority, and 20.5 percent of the populations have incomes below the poverty level. Monroe County is approximately 2.8 percent minority, and 19.3 percent of the populations have incomes below the poverty level. Summers County is approximately 7.0 percent minority, and

25.8 percent of the populations have incomes below the poverty level. Raleigh County is approximately 17.5 percent minority, and 17.7 percent of the populations have incomes below the poverty level. The population within Giles, Monroe, and Raleigh counties is not considered minority or low-income and, therefore, would have no disproportionate impacts. While Mercer and Summers County do not have low-income levels which are drastically different from those of surrounding counties, the poverty levels in these counties do exceed the 20 percent threshold established under Environmental Justice guidance. Therefore, there is a potential for disproportionate impacts in these counties. However, impacts associated with the construction of the TSP would be experienced by both low-income and non-low-income individuals within these counties; therefore, no disproportionate impact would be borne by low-income populations.

In Summers County, 17 percent of children are 18 and under and 4 percent of the population are five years or younger (Table 4-19). There may be moderate, disproportionate impacts on children due to the implementation of the TSP, particularly increased air and noise emissions from heavy construction equipment along with reduced opportunities for recreation which have been diminished since the year 2000 and would be expected to continue through the duration of the TSP. These impacts would cease when construction is complete and disturbed areas would be restored.

5.14.1.2 Indirect Effects

Long-term growth in the area would be impacted by multiple factors. It is not possible to predict the long-term impact of the implementation of the TSP.

5.14.1.3 Commitments and Mitigation Measures

Plans for the mitigation of construction impacts on residents' quality of life in the vicinity of the dam include flagmen, signage, cones, barricades, and detours to be used where required facilitating movement of construction equipment, construction materials, and local traffic on affected road segments. In addition, road damage resulting from heavy truck and machinery traffic would be repaired as part of the project. Truck traffic delivering materials through Bellepoint and other residential areas would be limited to the hours of 9:00 a.m. to 2:00 p.m., Monday through Friday. If during construction it is determined that staging areas and access or haul roads would be situated outside the areas of analysis, a supplemental environmental document would be necessary.

5.14.2 Alternative 2: No Action

5.14.2.1 Direct Effects

The No Action Alternative would have devastating consequences if dam failure were to occur. A flood of such a magnitude would cause loss of life and loss of vital services. High water would force the closure of railroads and Federal and State highways.

Most of the designated public shelters would be inundated by this level of flooding. Portions of five county school systems would also be inundated with the majority of the Kanawha County school system inundated. These same school systems have a dual function as public shelters, so the remaining schools would be heavily used and overcrowded. Over 90 percent of all wholesale, retail, and service jobs in Kanawha County would be inundated, including one of the major chemical producing centers in the U.S.

The population within the inundation areas may not return to the area in the event of dam failure resulting in adverse impacts on populations and the economy. Community cohesion in the project area, in particular, has already been affected by the on-going DSAS construction. Although community cohesion may be currently lacking or reduced, the construction of the previously approved dam safety modifications would result in a reduced risk from a failure of Bluestone Dam afforded to the individuals in the area. However, under the No Action alternative, the risk of dam failure in the event of the PMF under the No Action alternative exceeds tolerable risk levels and therefore has a higher risk of dam failure than the TSP. There would be adverse impacts on community cohesion throughout the study area in the event of a dam failure.

Under the No Action Alternative, this is an increased risk of dam failure which would inundate many roadway segments in the project area making them temporarily inaccessible in the event of dam breach or failure.

There is a potential for disproportionate impacts on low-income populations in Summers and Mercer counties because the poverty levels in these counties do exceed the 20 percent threshold established under Environmental Justice guidance. However, impacts associated with the construction of the on Phase 3 and 4 and remaining DSA components would be experienced by both low-income and non-low-income individuals within these counties; therefore no disproportionate impact would be borne by low-income populations. The No Action alternative would be expected to cause moderate, disproportionate impacts on children due to the construction activities under the No Action, particularly increased air and noise emissions from heavy construction equipment; however, these impacts would not be permanent and would cease when construction is complete.

5.14.2.2 Indirect Effects

Long-term growth in the area would be impacted by multiple factors. It is not possible to predict the long-term impact of the implementation of the No Action Alternative.

5.15 Public Safety Resources

5.15.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.15.1.1 Direct Effects

Implementation of the TSP would involve various features and risk management measures formulated to ensure stability of the stilling basin and the dam during extreme flood events to reduce the risk of a dam failure. The TSP was designed to reduce risk of dam failure thereby restoring flood risk management benefits for the communities downstream of the dam. Modifications made to the dam under the TSP would mitigate downstream consequences of potential dam failure, which include loss of life and significant property damage.

However, as the dam reduces, but does not eliminate risks associated with flooding, even with implementation of the TSP there may still be widespread flooding during extreme flood events. Flooding would occur along the New and Kanawha Rivers and the lower reaches of the Greenbrier, Gauley, and Elk Rivers and communities along these rivers within the PMF inundation area. The future population and development upstream and downstream of the dam was assessed to determine the population at risk, which is estimated at 165,000. While development and population is expected to increase slightly upstream of the dam, the difference is not appreciable over the near future. It was also determined that there would not be a significant change to population at risk due to future development and/or redevelopment of areas downstream of the dam in the Kanawha Valley including Kanawha, Putnam, and Mason counties.

Flooding from extreme events, including the PMF would cause a loss of vital services such as fire, ambulance, hospitals, water and wastewater treatment, public shelters, power production, and transportation systems. During peak flooding, many evacuation routes would be cut off and most evacuation centers would be inundated. This would make it difficult for emergency services and rescue workers to get to residents. Any prediction of significant spillway releases would trigger warnings and evacuations in the at-risk areas near the river. The adverse impacts on public safety associated with Dam failure would be greatly reduced by the TSP.

5.15.1.2 Indirect Effects

While major uncontrolled flooding would result from extreme flood events, modifications to the dam under the TSP would strengthen the dam so that the possibility of failure or breach and associated flooding would be greatly reduced.

Flooding from extreme events including the PMF could cause a potential hazardous chemical spill from any of the industrial areas and sewage treatment plants within the Kanawha River Valley that could put human health, property, and water supplies at risk for an unknown distance downstream and duration of time would cause significant impacts. Both gaseous emissions and widespread water contamination could result from flooding. Some hazardous chemicals could become airborne, posing risk from inhalation that would have effects outside of the inundation area. The chemicals could result in flooded structures requiring decontamination after flooding, and it could also put first responders at higher risk. Many of the chemicals used in the valley are highly toxic in low concentrations including chlorine, organic chemicals, antifreeze, pesticides, herbicides, and the chemical precursors of these compounds. It is reasonable to assume that a flood could cause significant chemical impacts to terrestrial habitat, aquatic habitat, and susceptible communities along the entire river valley.

5.15.1.3 Commitments and Mitigation Measures

Summers County has not had a major evacuation in the past. Although the county has an evacuation plan which follows the FEMA all-hazards plan, many of the residents are elderly and evacuation could be difficult. There are also concerns that many residents would refuse to leave their home and at peak flooding many evacuation routes would be cut off and most evacuation centers would be inundated. Other counties that could be impacted have similar evacuation plans and concerns. However, the TSP would include the non-structural risk management measures which include an enhanced risk communication plan to regularly educate the downstream communities and public of the potential flood risk, emergency procedures, and shared responsibility intended to reduce the overall risk of life and property. These measures increase the mobilization or evacuation rate of the population and the percentage of population taking protective action. This in turn, decreases the expected incremental life loss from the PMF.

Development of warning signals and evacuation plans are an integral part of flood protection. Plans would be developed by the USACE in conjunction with cooperating agencies including the State and local emergency management offices. In particular, an emergency planning working committee has developed a program for managing hazardous chemical spills and airborne releases (Kanawha Putnam Emergency Planning Committee 2016). Contingency plans and evacuation plans have also been drafted to respond to flash flooding and other natural disasters (Kanawha County 2016). In addition, the Federal Emergency Management Agency (FEMA) has a Bluestone Response Plan in place and would coordinate with the DoD for military assistance. Signage will be placed within the project area to warn of increased risk of high lake levels, along with a website that will inform residents and visitors. Due to the increased probability of higher levels of water, USACE is considering the use of gates to close campsites when inundated or pending inundation for the safety of the public.

5.15.2 Alternative 2: No Action

5.15.2.1 Direct Effects

Under the No Action alternative, there is a greater risk of dam failure than the TSP. Property and other economic damages and the potential for loss of life would be higher compared to risks present during floods without dam failure. A failure or breach of Bluestone Dam could potentially result in significant impacts on public health and safety. Adverse impacts including economic damage and loss of life could occur upstream and downstream of the Bluestone Dam. The resulting downstream damage from failure of the dam would be over $19 billion (USACE 2016c). Sudden failure of the Bluestone Dam would result in catastrophic flooding on the New and Kanawha Rivers and the lower reaches of the Greenbrier, Gauley, and Elk Rivers, with a significant increase in property damage and a high potential for loss of life. A dam failure would cause severe flooding in Hinton, particularly in Bellepoint just below the dam. However, flooding would also occur to communities along the New and Kanawha River within the inundation area.

5.15.2.2 Indirect Effects

Dam failure or breach from extreme flood events would cause significant loss of vital services. There's the potential loss of John Amos Power Plant, one of the region's largest power suppliers, and up to five large hospitals comprising the Charleston Area Medical Center that would likely be forced to evacuate. Damage to the industrial area along the Kanawha Valley would cause extensive contamination from hazardous substances. Damage to USACE navigation structures (London, Marmet, and Winfield lock and dams) could cause loss of navigation pools along the Kanawha River that would severely impact the ability to transport coal and other critical goods. Regional rail assets would probably be damaged as well. Most of the major industry, businesses, services, and government buildings in Charleston would also likely be significantly impaired.

5.16 Hazardous, Toxic, and Radioactive Waste

5.16.1 Alternative 1: TSP-Hydraulic Jump Basin with Supercavitating Baffles

5.16.1.1 Direct Effects

Based on the Phase I ESA investigation (Appendix L) there are no environmental concerns that would impact construction activities in the proposed CWL and no additional HTRW Investigations including Phase II investigations are required or recommended for the project area investigated. During the Phase I ESA investigation site visit on the right bank of the New River downstream of the dam, a petroleum containment area was observed and no spills or stained areas were observed outside of the containment area. Several diesel ASTs were observed around the emergency stilling basin utilized to refuel the compressors, generators, and cranes and no staining was observed near the ASTs. No environmental concerns were observed on the left bank of the New River downstream of the dam. In addition, no environmental concerns were observed within the CWL along WV Route 20 and the New River from WV Route 3 Bridge to the fishing pier road. A 250-gallon diesel AST is located inside the dam for the emergency generator. There has never been a diesel spill associated with this AST. Three USTs next to the maintenance building were removed in 1992. At the time of removal, no evidence of contamination was apparent in the tank pit, and confirmation samples taken at the time came back clean.

During project implementation as part of the on-site review, USACE would revalidate the Phase I assessment findings contained in the Phase I ESA report for all properties in the CWL and if necessary, recommend Phase II (a) HTRW Investigations. This revalidation would not be a repeat of the original investigation, but rather a confirmation that there have been no changed conditions that would affect the conclusions reached by the original investigation, or to delineate the extent of the confirmed contamination in order to estimate the actual remediation costs.

If the design plans undergo further changes that require any additional properties for dam safety modification construction or mitigation, those properties would have to be evaluated for any HTRW concerns. Where changed conditions indicate the potential exists for hazardous substances regulated under CERCLA or hazardous wastes regulated under RCRA, a Phase II (a) HTRW investigation would be performed.

If construction should reveal the existence of previously unknown HTRW, then work would stop until the risk from HTRW can be evaluated and an appropriate response determined. In addition, if hazardous waste would be encountered during construction, the contamination would be managed following WVDEQ guidelines.

The potential to create HTRW materials during the construction process is always a possibility. A limited amount of hazardous materials and waste, including petroleum, oil, and lubricants, would be generated during routine maintenance and operation of any equipment. Storage, fueling, and lubrication of equipment and motor vehicles associated with the construction process would be conducted in a manner that affords the maximum protection against spill and evaporation. USACE construction contractors would be required to provide and implement SWPPP and SPCCP plans.

The potential impacts of the handling and disposal of hazardous and regulated materials and substances during construction of the TSP would be minimal when BMPs are implemented.

5.16.1.2 Indirect Effects

If flow conditions during construction require the demobilization of the construction contractor to allow use of more than eight sluice gates at once during a high flow event, the timeframe of such demobilization may not allow total removal of all equipment and cleaning of all mechanical/hydraulic fluids and supplies within the cofferdam prior to flows being passed through the area. Although the probability of such a flow event and demobilization is low, the event could lead to release of pollutants into the downstream area. Such a release could have a minimal to moderate short-term impact on water quality in the downstream area. Additionally, USACE contractors would be required to develop a site specific SPCCP prior to the start of construction, thus minimizing the threat of such a release.

5.16.1.3 Commitments and Mitigation Measures

The USACE contractor would use BMPs as standard operating procedures during all construction activities, including proper handling, storage, and/or disposal of hazardous and regulated material. The contractor would be responsible for any hazardous waste generated during construction and would also be required to collect, characterize, label, store, transport, and dispose of all non-recyclable hazardous and regulated wastes, as regulated by the USEPA, to comply with RCRA and other applicable laws and regulations. Fuel, lubricants, and oil would be managed and stored in accordance with all Federal, state, and local laws and regulations. The refueling of machinery would be completed following accepted USACE guidelines, and all vehicles would have drip pans to contain minor spills and drips.

5.16.2 Alternative 2: No Action

5.16.2.1 Direct Effects

The prolonged construction duration for the 1998 DSAS project features minimally increase impacts to HTRW. The area's waterways may have been at an increased risk of potential contamination by solvents, petrochemicals and other contaminants; however, BMPs were followed for the duration of construction and thus the risk of contamination was minimized.

Impacts under the No Action alternative during construction of Phase 3 and 4 and the rest of the DSA components would be similar to Alternative 1. The potential impacts of the handling and disposal of hazardous and regulated materials and substances during construction of the TSP would be minimal when BMPs are implemented.

5.16.2.2 Indirect Effects

Dam failure under the No Action Alternative would cause significant damage to the industrial area along the Kanawha Valley which would cause extensive contamination from hazardous substances. Both gaseous emissions and widespread water contamination could result from flooding due to dam failure. Some hazardous chemicals could become airborne, posing risk from inhalation that would have effects outside of the inundation area. The chemicals could result in flooded structures requiring decontamination after flooding, and it could also put first responders at higher risk. Many of the chemicals used in the valley are highly toxic in low concentrations including chlorine, organic chemicals, antifreeze, pesticides, herbicides, and the chemical precursors of these compounds. It is reasonable to assume that a flood could cause significant chemical impacts to terrestrial habitat, aquatic habitat, and susceptible communities along the entire river valley.

5.17 Other Social Effects

5.17.1 Alternative 1: TSP-Hydraulic Jump Basin with Super-Cavitating Baffles

TSP construction has the potential to adversely impact project area identity, social connectedness, economy, and recreation and leisure. The communities and area visitors have a long standing connection to the landscape and opportunities created by Bluestone Dam.

Construction duration for the TSP is proposed to last between eight to ten years and is scheduled to begin after completion of Phase 3 and Phase 4 of the 1998 DSA Project. The construction area impacted by the TSP is expected to be similar to the DSA Project with a concrete batch plant located in a similar location on the east bank of New River next to the Hinton Park and Recreation area, and a staging area located on the west bank of the dam that requires the removal and relocation of the ADA-accessible fishing pier. Construction of the TSP requires the installation of concrete within the stilling basin. Because this area must be dry during construction, the stilling basin would be divided into two halves, reducing the number of operating sluice gates from sixteen to eight during construction. To aid in dewatering, a temporary cofferdam would be constructed across the downstream portion of the dam and would tie into the penstock training wall and the adjacent training wall on the west or left-descending bank. These facets of construction would have social impacts on the community, as described below.

5.17.1.1 Other Social Effects Impacts to Group Identity, Social Connectedness, Economic Impact, and Leisure and Recreation

Direct effects of TSP construction to the upstream portion of the project include areas in Bluestone State Park, Bluestone Wildlife Management Area, Bluestone Conference Center, and Glen Lyn Park that are prone to frequent flooding. The areas would continue to be inundated and would experience longer durations and higher elevations of inundation due to the reduced number of sluice gates available to drain Bluestone Lake during construction. The impacts can be considered both short and long-term in duration in that the impacts from a single flood event would be short-term while the duration of construction ranging from eight to ten years is long-term. It is estimated that, on average under current conditions, the area experiences 18 days of flooding that impacts recreation each year. During construction of the TSP that number of days would be approximately three times longer, resulting in approximately 54 average annual days of out of pool conditions each year. The extent of the effects depends on the time of year and the magnitude and duration of the flood event.

TSP construction impacts to the downstream portion of the project would have long-term durations and include removal of the current ADA-accessible fishing pier, the continued closure of recreation fields and the walking path located in the Hinton recreation facility on the east bank of New River (these have been closed since DSA construction began), and access to fishing on and near the dam because of the buffer zone that would be required during construction. As discussed in 5.11 mitigation measures would be implemented to compensate for significant downstream recreational impacts.

5.17.1.1.1 Group Identity

The identities of the local residents and visitors are deeply rooted in the communities that surround the project area. The communities offer a pristine environment where residents and visitors connect with nature and enjoy common interests and values. Potential project impacts could lead to a change in their identities by diminishing, for eight to ten years, the availability to resources (fishing, boating, camping, and hunting).

5.17.1.1.2 Social Connectedness

The communities surrounding Bluestone Dam use the water resources created by the project as a place where they can connect for festivals, family reunions, family vacations, and other social events. If these community interactions are interrupted or altered due to short-term and long-term project impacts, then it could disrupt social connectedness and potentially threatens the area's sense of community. Part of this disruption of social connectedness could lead to differing views of the project within the immediate area and its effects on the community, economy, recreation, and other aspects of local life.

5.17.1.1.3 Economic Impact

The TSP offers positive long-term impacts to the local economy in the form of construction jobs, expenditures for construction materials, and indirect spending in the local communities by construction workers on items such as food, gasoline, entertainment, and miscellaneous items.

Lands within the project area provide a vital role in the economy by attracting visitors who spend money for lodging, food, gasoline, supplies, and entertainment. These visitors are vital to the economy in that many restaurants and businesses operate only during the peak tourism season. No economic impact studies have been conducted; however, there have been recent studies for WV as a whole. According to the Outdoor Industry Foundation, recreation in WV contributes roughly $7.6 billion annually and supports 82,000 jobs with $2 billion in wages and $532 million in tax revenue (Outdoor Industry Association 2016). Additionally, the 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation for WV (revised in 2014) estimates that fishermen, hunters, and wildlife-related recreational users spend, per day, roughly $72, $22, and $28, respectively, when in WV. Construction would diminish, though not eliminate, project area revenues from these sources (USFWS-U.S. Census Bureau 2011).

If the TSP causes impacts to the recreation-driven income of the community, it could have adverse long-term impacts on the area's economy which has been suffering from the loss of the coal industry and relies on tourism to replace the jobs and tax revenue.

5.17.1.1.4 Leisure and Recreation

Construction at Bluestone Dam has impacted, and would continue to impact, the local population. The downstream portion of the project area would experience adverse impacts caused by relocation of the fishing pier and reduced hiking and viewing opportunities near the dam. However, the greatest impact is the loss of land required for the onsite concrete plant at the sports recreation facility. The amount of land available for recreation and organized sports has been drastically reduced to accommodate the plant. Because construction is anticipated to last eight to ten years, beyond the existing construction, additional populations of youth would miss out on adequate recreation opportunities.

Construction impacts to recreation on upstream portions of the project area include those to fishing, hunting, camping, hiking, picnicking, motorized boating, and canoeing.

5.17.2 Alternative 2: No Action

5.17.2.1 Other Social Effects Impacts to Group Identity, Social Connectedness, Economic Impact, and Leisure and Recreation

The No Action Alternative excludes TSP construction. Ongoing DSA construction would continue to impact the project area. The No Action alternative includes the short-term and long-term direct effects to downstream portions of the project area resulting from prolonged DSA construction.

This includes the closure of recreational fields in the area operated by the City of Hinton that once served as an additional baseball and football practice field. The closure of the recreational fields has created a shortage of capacity to handle the demand of the population and has resulted in a reduction of practices and number of games the youth can participate in. In addition, the DSA construction has resulted in the closing of a walking path that has caused users to move to alternative locations.

Positive long-term impacts to the local economy would still result from the continuing DSA construction in the form of jobs in the construction industry, expenditures on construction materials, and indirect spending in the local communities by construction workers.

The effects caused by the No Action Alternative could lead to long-term and permanent impacts if a failure of Bluestone Dam occurred, which would completely devastate the area assessed in this SDEIS. Extreme flooding from a dam breach would eliminate community cohesion for an extended period as residents are forced to either temporarily or permanently relocate. The recreation activities enjoyed by locals and that drive the tourism based economy would essentially be eliminated for an extended period of time, changing the culture and community connectedness these activities currently foster.

6.0 CUMULATIVE IMPACTS

6.0 CUMULATIVE IMPACTS

This section of the SDEIS addresses the potential cumulative impacts associated with the implementation of the TSP and other projects/programs that are planned for the study area. The cumulative impacts (also termed cumulative effects) of the proposed project on the environment as stipulated in NEPA must be considered. As defined by the CEQ, cumulative effects are "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions." Cumulative impacts can result from individually minor but collectively significant actions taking place over time (40 CFR Part 1508.7).

6.1 Methodology

Cumulative environmental effects for the proposed project were assessed in accordance with guidance provided by the CEQ's *Considering Cumulative Effects under the National Environmental Policy Act* (CEQ 1997), and *Memorandum and Guidance on the Consideration of Past Actions in Cumulative Effects Analysis* (CEQ 2005). An evaluation of other regionally similar actions or actions potentially resulting in adverse impacts or beneficial effects on similar regional resources that have occurred in the past, currently underway, or planned for the foreseeable future must, therefore, be considered.

Consideration of cumulative impacts has been long required under regulations of NEPA, but it is a difficult and evolving area of study because it requires (1) assessing effects over larger (i.e., regional) areas, (2) assessing effects over longer periods of time including the past and future, and (3) interpreting interactions among multiple, complex, and dynamic human activities. From the Chairman of the CEQ to the Heads of Federal Agencies (CEQ 2005), the CEQ made clear its interpretation that "…generally, agencies can conduct an adequate cumulative effects analysis by focusing on the current aggregate effects of past actions without delving into the historical details of individual past actions…" and that the "…CEQ regulations do not require agencies to catalogue or exhaustively list and analyze all individual past actions."

The first step in assessing cumulative impacts is to identify which resources to consider in the analysis. All impacts on affected resources can be called cumulative. However, according to CEQ guidance, "the role of the analyst is to narrow the focus of the cumulative effects analysis to important issues of national, regional, or local significance" (CEQ, 1997, p. 12). In addition to this "relevancy" criterion, only those resources expected to be directly or indirectly affected by the TSP as well as by other actions within the same geographic scope and time frame were chosen for the analysis. Based on these criteria, the following resources were identified as target resources for the cumulative effects analysis:

- Noise
- Vegetation
- Water and aquatic resources

- Wildlife
- Air
- Socioeconomics

The next steps included:

- identifying past, present, and reasonably foreseeable future projects that have the potential to add impacts on each resource;
- considering the direct impacts of the TSP on each identified resource, as summarized in Section 3.0 and presented in detail in section 4.1 to 4.17.
- summarizing the magnitude of the cumulative effects of the projects and actions on the affected resources.

6.2 Past, Present, and Reasonably Forseeable Future Projects

As the majority of direct and indirect impacts to the project area from the TSP are expected to occur within Reconnaissance Area 1, research into other past, present, and reasonably foreseeable projects was focused on projects in the vicinity of this area, including past and ongoing construction of the 1998 DSAS features. In general, the watershed within which Reconnaissance Area 1 sits has seen relatively little new development over the past 20 years, and that trend is expected to continue for the foreseeable future.

6.2.1 Construction of Previously Assessed DSAS Features

Dam modifications completed to date and the ongoing Phase 3 and 4 works are described in detail in Section 2.0. These actions have contributed a large portion of the cumulative impacts to the project area, given that they have occurred and continue to occur within the dam footprint.

6.2.2 Residential Development

In Summers County, WV residential building permits have averaged 22 per year since 2001, seeing an overall downward trend since a high of 40 permits in 2003. All of the building permits are for Single Family housing units. Hinton, WV has averaged two residential building permits per year since 2001. While Giles County, VA has seen greater overall residential development than Summers County, with a high of 67 permits in 2005, the county has seen a steady drop in permits since 2005 (Homefacts 2016). This low level of residential development in these two counties, which make up a majority of land within Reconnaissance Area 1, demonstrate the overall low level of development within the area over the past 15 years.

6.2.3 General Construction

Virginia requires that any construction disturbing one or more acres obtain a Construction Stormwater General Permit from the VDEQ. A June 2016 review of VDEQ's list of active Construction Stormwater General Permits showed only two active permits in Virginia in the vicinity of Reconnaissance Area 1. A June 2016 review of WVDEP's database of active permits showed nine Construction Stormwater permits in the vicinity of Reconnaissance Area 1 (Table 6-1). In total, the cumulative acreage impact of these projects, approximately 262 acres, is rather minor when compared to the expanse of undeveloped land in the vicinity of Reconnaissance Area 1.

Table 6-1. Active Construction Stormwater General Permits in the Vicinity of Reconnaissance Area 1

Project	Location	Acres Disturbed
Celanese Gas Pipeline Upgrade Project	Giles County, VA	68
Giles County Public Safety Building	Pearisburg, VA	1.92
Lilly Bridge	Bluestone/New River confluence	8.15
Seminole Road	Seminole, WV	3.03
Lilly Bridge Waste Area #1	Bluestone/New River confluence	4.88
Relocated Pits Road (Lilly Bridge)	Bluestone/New River confluence	10.53
Bluestone Dam Safety Assurance Phase 3	Bluestone Dam	20.71
Hinton Area Sewer Extensions-Phase 1A- Gold Coast	Hinton, WV	2.86
Seminole Road Excess Material Site	Seminole, WV	2.94
Forest Hill Tower and Access Road Grading	Seminole, WV	2.8
Columbia Gas Transmission Giles County Project	Ballard, WV	136

Source: WVDEP 2016b, VDEQ 2016b.

6.2.4 Transportation

The WV Draft Statewide Transportation Improvement Program for fiscal years 2016-2021 does not include any federally funded projects in the vicinity of Reconnaissance Area 1, and only three state funded projects (WVDOT 2016). Fifty-four state funded road projects received funding for construction between 2011 and January 2016 within Summers County, some of which occur within 2.5 miles of the dam. These projects included resurfacing, replacement of culverts, and rock removal. (WVDOT 2013).

The closest transportation project to Bluestone Dam is the replacement of Lilly Bridge, where WV Route 20 crosses the Bluestone River at its confluence with the New River. The project began in early 2013 and is scheduled to be complete by the end of 2016. Construction included installation of new bridge piers into existing river bedrock, as well as the construction of a temporary construction roadway into the Bluestone River consisting of sheetpile and fill material.

6.2.5 Logging

In Summers County, as of June 2016, 455 timber harvests were registered as occurring since 2000 totaling 31,385 acres, according to WV Department of Forestry records (WVDF personal communication).

6.3 Summary of Cumulative Impacts to Resources in Reconnaissance Area 1

Past, present, and reasonably foreseeable projects outside of the immediate dam area have produced, or would likely produce, noise disturbances of various degrees. The additional traffic and construction equipment associated with the construction of the TSP and other projects in the area would increase the noise in the study area, leading to an overall reduction in quality of life for area residents. While the TSP would add to the overall cumulative impact of noise on wildlife as well, the total cumulative impact of noise on wildlife throughout Reconnaissance Area 1 is minimal given the limited construction and development within this area. Large swaths of undisturbed terrestrial habitat occur throughout Reconnaissance Area 1 to which more mobile species can easily move during disturbances near the dam; therefore, the cumulative impact of noise on wildlife within the larger Reconnaissance Area 1 due to the TSP would be negligible despite it being long-term, though non-permanent.

Terrestrial habitat has been and would likely be impacted by construction of projects such as those listed in Table 6-1, as well as logging in the vicinity of Reconnaissance Area 1. The clearing of vegetation under the TSP would add to this impact, though the additive impact would be negligible given the limited acreage of vegetation removal under the TSP as compared with other projects in the area. Similarly, the cumulative impact to terrestrial wildlife due to loss of terrestrial and riparian vegetation under the TSP would be negligible given the abundance of similar, high-quality habitat elsewhere in the area.

While most of the projects listed in Table 6-1 do not directly impact water or aquatic resources, the replacement of Lilly Bridge has had direct impacts on these resources. Lilly Bridge is located approximately 2.5 miles upstream of Bluestone Dam, crossing the Bluestone River near its confluence with Bluestone Lake. As part of the bridge construction, new pilings have been driven into the riverbed and a construction causeway consisting of sheetpile and fill material was temporarily built within the Bluestone River, filling aquatic habitat and likely causing suspension of silty sediments within the Bluestone River. This increase in suspended solids likely led to increased sedimentation within Bluestone Lake, as the construction is situated at the confluence of the two waterbodies. The increased sedimentation of Bluestone Lake under the TSP would add slightly to this adverse impact.

Similarly, while Stormwater Pollution Prevention Plans and the use of BMPs would be required for any construction project in the vicinity of Reconnaissance Area 1, there could nonetheless be a risk of erosion at project sites, leading to increased suspended solids and sedimentation within the New River. Likewise, while timber projects in the area may not have a direct impact on water or aquatic species and are likely required to have sediment controls, they could add to hillside erosion in Reconnaissance Area 1, which could result in increased sedimentation within Bluestone Lake or downstream of the dam, depending on the location of the logging tract. Construction of the TSP would not be expected to add more than a negligible cumulative impact from erosion-based sedimentation due to the use of BMPs during construction.

The TSP, in addition to the ongoing DSAS construction features would have cumulative beneficial impacts on socioeconomics. These projects would decrease the risk of dam failure and provide risk reduction benefits to all residents and businesses. Short-term cumulative socioeconomic benefits from the TSP, DSAS construction and other construction and logging projects in the area are realized through the expenditure of billions of dollars in the region, which directly provides jobs, benefits businesses through the purchases of materials and supplies, and provides sales tax revenues to local governments.

The cumulative effects on air quality in the project area from construction of the TSP, along with construction of the ongoing DSAS features and other transportation projects would be moderate and long-term but non-permanent. Once the TSP construction is complete, air emissions would be negligible and limited to the vehicles that maintenance workers use to maintain and operate the dam.

The construction activities, transportation of large quantities of materials, and construction equipment associated with the construction of the TSP, ongoing DSAS features, and other transportation projects would lead to a significant increase in traffic volume throughout the project area. The TSP in conjunction with other projects could increase wear-and-tear on vicinity roads, and would thus have short-term cumulative adverse impacts on transportation. The increased construction traffic could also cause temporary congestion and traffic delays and could also potentially increase traffic accidents and related traffic fatalities.

The construction of the TSP in addition to the ongoing DSAS construction impacts would continue to impact the recreational activities for the local population. The loss of the fishing pier and other fishing opportunities just downstream of the dam would have long-term cumulative impacts. With construction in this area occurring over nearly 30 years, there is a possibility that an entire generation of youth would have a loss of recreational opportunities for their entire childhoods including fishing near the dam and ball fields at Hinton Park.

The implementation of the TSP and ongoing DSAS project would provide cumulative beneficial impacts to cultural resources through decreased risk of dam failure. However, there could be cumulative adverse impacts on known or unknown cultural resources due to development which may occur in the area as result of the reduced threat of dam failure.

7.0 COMMITMENTS AND MITIGATION MEASURES

7.0 COMMITMENTS AND MITIGATION MEASURES

7.1 Unavoidable Adverse Environmental Effects

Adverse environmental impacts under the TSP have been avoided or minimized through the following design and construction:

- Use of BMPs and a SPCC to control erosion and minimize the risk of contamination of water resources within the project area
- Design of a stilling basin dewatering system that minimizes the physical footprint of impact and allows for continued flow through the dam, based on the minimum space required to mobilize equipment and perform construction of all features
- Minimize and avoid clearing of vegetation to the maximum extent practicable
- Seasonal restrictions for tree clearing to prevent taking bird nests, eggs, and young (between September 1 and March 31, which is outside the nesting season for most native bird species)
- Proper and routine maintenance of all vehicles and other construction equipment
- Implementation of dust suppression methods to minimize fugitive dust
- Maintenance of filters at the concrete plant would be followed and equipment and procedures to contain concrete dust generated during transfer and storage
- Use of most quiet practicable equipment, maintenance of equipment in good working order or using newer equipment, employing shields that are physically attached to a piece of stationary equipment, using sound aprons and dampeners, and muffling the internal combustion engines on the equipment
- Scheduling of construction activities for times when there is a higher level of community noise already present and in such a fashion as to avoid quiet times, operation of noisy equipment only when necessary and turning off equipment when not in use, and positioning noisy operations as far away from noise sensitive areas as possible
- Truck traffic passing through residential areas would be limited to the hours of 9:00 a.m. through 2 p.m.
- Use of flagmen, signage, cones, barricades, and detours to be used where required to facilitate movement of construction equipment, construction materials, and local traffic on affected road segments
- Non-structural risk management measures including an enhanced risk communication plan to regularly educate the downstream communities and public of the potential flood risk, emergency procedures, and shared responsibility intended to reduce the overall risk of life and property
- Use of BMPs during all construction activities, including proper handling, storage, and/or disposal of hazardous and regulated material
- Used lubricants and used oil would be stored in marked corrosion-resistant containers and recycled or disposed of in accordance with appropriate requirements
- Refueling of machinery would be completed following accepted USACE guidelines, and all vehicles would have drip pans to contain minor spills and drips

- Staging and construction areas (batch plants) would be restored to preconstruction conditions suitable for the re-establishment of vegetation to the maximum extent practicable
- Use of signage placed within the project area to warn of increased risk of high lake levels, along with web-based information and/or call-in number inform residents and visitors
- Addition of, or modification of existing gates to close affected campsites if currently inundated or if inundation is forecasted to enhance safety.
- USACE would be committed to active and prolonged outreach to media outlets to inform the public of when facilities would be unavailable as a measure to mitigate for recreation impacts
- USACE would also conduct outreach in order to inform potential Bluestone recreational visitors through media markets through the period of construction of current lake and river conditions

Despite these avoidance and minimization efforts, the following long-term, non-permanent impacts are unavoidable during construction of the TSP:

- Significant disturbance of 62.5 acres of USFWS Resource Category 1 aquatic habitat due to construction of the temporary cofferdam, increased sedimentation and flow alteration
- Moderate noise disturbance to communities and wildlife
- Negligible reduction in aquatic food source abundance and minimal reduction in fishing quality
- Negligible to significant inundation of plants upstream of dam
- Moderate impacts on air quality during construction and minor impact on regional greenhouse gas budget
- Moderate impacts on ambient noise environment and the resulting reduction in community cohesion and property value
- Moderate adverse effects to upstream recreation sites due to increased frequency, magnitude and duration of inundation, resulting in reduced use by local and non-local visitors
- Moderate impacts visual quality, serenity and field availability of Hinton City Park and disruption of visual character of tailwater flow
- Moderate impact on transportation, resulting in lower level of service on area roads
- Minimal to significant impact on group identity, social connectedness, economy, leisure, and recreation
- Possible impact to recreation economy if reduced use of upstream recreation sites leads to permanent use of alternate sites by some visitors

The following long-term, permanent impacts are unavoidable:

- Removal of less than one acre of riparian habitat
- Minimal increased sedimentation within Bluestone Lake

- Negligible impact to geological resources and construction within floodplain at dam site
- Negligible soil erosion in areas cleared for construction
- Removal of the ADA-accessible public fishing pier on left descending bank
- Long-term, minimal impact to visual character of dam due to construction of divider wall in the center of the stilling basin
- Potential erosion, siltation, and displacement of cultural resources and artifacts

7.2 Mitigation for Unavoidable Impacts

For impacts which could not be avoided, USACE will compensate for such impacts through the following mitigation measures:

- River banks and slopes that are directly disturbed by construction activities will be revegetated with native trees and shrubs
- Aquatic habitat within the tailwater area impacted by the temporary cofferdam/causeway and altered flow will be restored to baseline conditions. Additionally, off-site mitigation will be completed for 50.94 aquatic Habitat Units at a site yet to be determined. Criteria for the site is provided in Section 5.3.1.3 and USFWS recommendations are provided in Appendix D
- Road damage resulting from heavy truck and machinery traffic would be repaired as part of the project
- Stipulations detailed in the MOA will be implemented for cultural resources
- Construction of a new ADA-accessible fishing pier downstream of the dam prior to the removal of the existing fishing pier
- Replacing the existing ADA-accessible public fishing pier in the same approximate location when the TSP and DSA construction is complete.
- USACE will also consider additional opportunities upstream of the dam for water access for fisherman
- Provide additional aquatic species habitat in upstream areas by placing boulder clusters for shelter and structure

The mitigation plan will be developed in accordance with ER-1105-2-100 and WRDA 2007 Section 2036. At this time, a compensatory mitigation plan has not yet been fully developed. However, USACE has been working closely with USFWS and the WVDNR regarding appropriate mitigation and identifying potential mitigation sites. USACE, in cooperation with resource agencies have identified sufficient opportunities to achieve mitigation needed to offset effects. USACE will provide a conceptual mitigation plan within the Supplemental Final EIS which will describe multiple sites which will compensate for the 50.94 aquatic Habitat Units. However, a fully designed mitigation plan will not be completed prior to the Record of Decision. During the preconstruction engineering and design (PED) phase, the mitigation plan design and details shall be fully developed and will fully evaluate the benefits of the sites to appropriately compensate for the 50.94 Habitat Units and an Incremental Cost Analysis (ICA) shall be completed as part of the mitigation site selection. It is anticipated a Supplemental Environmental Assessment would be prepared documenting the mitigation. In addition, due to significant downstream impacts to recreational resources, the USACE is developing conceptual mitigation plans to replace lost recreational uses as discussed in this document.

7.3 Irreversible and Irretrievable Commitment of Resources

NEPA Implementing Guidance requires that environmental analyses include identification of “any irreversible and irretrievable commitments of resources which would be involved in the Proposed Action should it be implemented” (40 CFR 1502.16). Irreversible effects result primarily from the use or destruction of a specific resource that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource as a result of the action that cannot be restored.

Most of the impacts to area resources caused by construction of the TSP would persist only throughout the construction period of eight to ten years; although this construction duration is considered long-term, these impacts are not permanent and therefore are not necessarily irreversible. However, there are some impacts which could persist for many years past the construction completion.

Noise produced by the prolonged construction of the 1998 DSAS features, coupled by additional construction under the TSP, could cause a permanent relocation of some wildlife species away from the immediate dam area. Similarly, the continued noise and visual disturbance in the vicinity of Hinton City Park may further reduce the community cohesion and recreational enjoyment this area provides local residents.

Although inundation of recreation sites upstream of the dam is not a permanent impact of the TSP, the long-term and sporadic interruption of the area’s usability could cause an eventual reduction in the popularity of Bluestone Lake for recreation activities, shifting some local and non-local visitors’ use to other recreation areas.

Lastly, full recovery of the USFWS Resource Category 1 habitat and replacement of its value would not occur immediately upon restoration and mitigation of the habitat. Full recovery, such as reestablishment of species assemblages, could take years after the completion of the restoration activities.

8.0 LIST OF PREPARERS AND CONTRIBUTORS

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Table 8-1 lists the team members and preparers of relevant sections of this report.

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11.0 ACRONYMS AND ABBREVIATIONS

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ACHP	Advisory Council on Historic Preservation
ADA	Americans with Disabilities Act
ALARP	As Low As Reasonably Practicable
APE	Area of Potential Effect
ARPA	Archaeological Resource Protection Act
ARRA	American Recovery & Reinvestment Act
ASTM	American Society for Testing and Materials
BCC	Birds of Conservation Concern
BCRA	Baseline Condition Risk Assessment
BMP	Best Management Practices
BTU	British Thermal Unit
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, & Liability Act
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
CFS	Cubic Feet Per Second
CH_4	Methane
CNEL	Community Noise Equivalent Level
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CWA	Clean Water Act
dB	Decibel
dBA	A-weighted decibel
DOD	Department of Defense
DSA	Dam Safety Assurance
DSAC	Dam Safety Action Class
DSAS	Dam Safety Assurance Study
DSMS	Dam Safety Modification Study
ECB	Engineering Construction Bulletin
ECRA	Existing Condition Risk Assessment
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
EQ	Environmental Quality
ER	Engineering Regulation
ESA	Endangered Species Act or Environmental Site Assessment
F	Fahrenheit
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
FPPA	Farmland Protection Policy Act
FRIS	Flood Risk Information System

FWAC	Future without Federal Action Condition
FWCA	Fish and Wildlife Coordination Act
FWCAR	Fish and Wildlife Coordination Act Report
GHG	Greenhouse House Gases
GIS	Geographic Information System
HEP	Habitat Evaluation Procedure
HFC	Hydrofluorocarbon
HTRW	Hazardous, Toxic, and Radioactive Waste
HU	Habitat Unit
HUD	U.S. Department of Housing and Urban Development
ICA	Incremental Cost Analysis
Ldn	Day-Night Sound Level
Leq	Equivalent Noise Level
m^3	Cubic meter
mg	Milligram
MCS	Management Classification System
MOA	Memorandum of Agreement
MOVES	Motor Vehicle Emission Simulator
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NGVD	North Geodetic Vertical Datum of 1929
NEPA	National Environmental Policy Act
NED	National Economic Development
NERI	New River Gorge National River
NFIP	National Flood Insurance Program
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
N_2O	Nitrous dioxide
NPS	U.S. National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetland Inventory
O_3	Ozone
OSHA	Occupational Safety and Health Administration
Pb	Lead
PCB	Polychlorinated biphenyl
PED	Preconstruction Engineering and Design
PL	Public Law
PM-2.5	Particulate matter less than 2.5 microns
PM-10	Particulate matter less than 10 microns
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation

ppb	Parts per billion
ppm	Parts per million
RCRA	Resource Conservation and Recovery Act
Rd.	Road
REC	Recognized Environmental Condition
RED	Regional Economic Development
RMP	Risk Management Plan
ROD	Record of Decision
SDEIS	Supplemental Draft Environmental Impact Statement
SEIS	Supplemental Environmental Impact Statement
SDWA	Safe Drinking Water Act
SFHA	Special Flood Hazard Areas
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO_2	Sulfur dioxide
SPCCP	Spill Prevention, Control, and Countermeasures Plan
SPRA	Screening Portfolio Risk Assessment
St.	Saint or Street
SWPPP	Stormwater Pollution Prevention Plan
TRG	Tolerable Risk Guidelines
TSP	Tentatively Selected Plan
U.S.	United States
USACE	U.S. Army Corps of Engineers
USC	United States Code
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	Underground storage tank
VA	Virginia
VDEQ	Virginia Department of Environmental Quality
VDH	Virginia Department of Health
VDHR	Virginia Department of Historic Resources
VIA	Visual Impact Assessment
VOC	Volatile organic compounds
VRAP	Visual Resources Assessment Procedure
WCM	Water Control Manual
WMA	Wildlife Management Area
WRDA	Water Resources Development Act
WUS	Waters of the U.S.
WV	West Virginia
WVDCH	West Virginia Division of Culture and History
WVDEP	West Virginia Department of Environmental Protection
WVDNR	West Virginia Department of Natural Resources
WVNHP	West Virginia National Heritage Program
WV SHPO	West Virginia State Historic Preservation Office

µg	Microgram
YOY	Young of Year

U.S. Army Corps
of Engineers
Huntington District